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SANDHOUSE (G. A.). **A new North American species of** *Crabro* **(Hymenoptera : Sphecidae).**—*Ann. ent. Soc. Amer.* **31** no. 1 pp. 1–4, 3 figs. Columbus, Ohio, March 1938.

DAVIDSON (R. H.) & LANDIS (B. J.). *Crabro davidsoni*, **Sandh., a Wasp predacious on Adult Leafhoppers.**—*T.c.* pp. 5–8, 3 figs.

The first paper describes both sexes of *Crabro davidsoni*, sp. n., from Ohio where, as recorded in the second paper, it is predacious on leafhoppers, 32 species of the genera *Empoasca*, *Typhlocyba* and *Erythroneura* being found in the galleries made for its larvae in decayed wood.

POWELL (D.). **The Biology of** *Cephalonomia tarsalis* **(Ash.), a Vespoid Wasp (Bethylidae : Hymenoptera) parasitic on the Sawtoothed Grain Beetle.**—*Ann. ent. Soc. Amer.* **31** no. 1 pp. 44–49, 12 figs. Columbus, Ohio, March 1938.

An account is given of the bionomics of *Cephalonomia tarsalis*, Ashm., parasitising larvae and pupae of *Oryzaephilus surinamensis*, L., in maize meal in Illinois. It is not considered of economic importance, as it is too susceptible to environmental resistance factors and has extremely low powers of reproduction.

KNOWLTON (G. F.) & SMITH (C. F.). **Notes on western Conifer Aphids (Homoptera : Aphididae).**—*Ent. News* **49** no. 3 pp. 65–69, 27 figs. Philadelphia, Pa, March 1938.

Records are given of 17 Aphids on conifers in the western United States, with descriptions of *Cinara thatcheri*, sp. n., on *Pinus ponderosa* in Idaho, *C. utahensis*, sp. n., on *Abies lasiocarpa* in Utah, and *C. utahensis zoolathridi*, subsp. n., on spruce trees in a nursery in Oregon.

CLEARE (L. D.). **Report on the Entomological Division for the Year 1936.**—*Divl Reps. Dep. Agric. Brit. Guiana 1936* pp. 85–88. Georgetown, 1938.

Several localised outbreaks of *Diatraea* occurred on sugar-cane in British Guiana in 1936 ; in some cases the injury was caused by larvae of *D. saccharalis*, F., though they subsequently became heavily parasitised by *Metagonistylum minense*, Tns., and in others the predominant species was *D. canella*, Hmps. [*cf. R.A.E.*, A **26** 221]. Other pests of sugar-cane were *Sipha flava*, Forbes, which is gradually becoming more prevalent, and the Dynastids, *Ligyrus ebenus*, DeG., *Euetheola* (*Dyscinetus*) *bidentata*, Burm., and *D. dubius*, Ol. (*geminatus*, F.). Coconut palms that were almost completely defoliated by *Brassolis sophorae*, L., recovered with remarkable rapidity where control measures [*cf.* **23** 61] were efficiently carried out, but in one village where 3,319 palms were infested, 8·4 per cent. were killed by the larvae. Coconuts were also attacked by *Tropidacris latreillei*, Perty, and rice by *Laphygma frugiperda*, S. & A., and *Mormidea poecila*, Dall.

PICKLES (A.). **Entomological Contributions to the Study of the Sugar-cane Froghopper. III. Observations on the Biology of certain neotropical Species of** *Tomaspis* **(Homoptera, Cercopidae).**—*Trop. Agriculture* **15** no. 3 pp. 56–65, 4 pls., 21 refs. Trinidad, March 1938.

This paper presents the results of investigations on the ecology and natural enemies of 11 species of *Tomaspis* in Brazil, Jamaica, and

Trinidad [*cf. R.A.E.*, A **23** 395], made to ascertain the possibility of introducing natural enemies into the sugar-cane fields of Trinidad for the control of *Tomaspis saccharina*, Dist. [*cf.* **21** 519, 646]. Most of the species discussed infest a wide range of plants and appear to be more attached to a particular plant community than to an individual species of plant. They may be classified into four groups, inhabiting, respectively, forest edges and clearings, high forest, savannahs and river banks. The savannah species of northern Brazil are of considerable interest, as their natural enemies would necessarily be adapted to the marked seasonal variations typical of such a habitat and would accordingly be most likely to survive cane-field conditions on introduction into Trinidad.

The author concludes that, from the economic standpoint, the information obtained is not encouraging. The natural enemies encountered were few in number and, for the most part, essentially the same in nature as those already known in Trinidad ; they are of limited value in controlling froghopper populations. The most efficient natural enemies are evidently the entomogenous fungi [*cf.* **21** 520], which, of all the biotic factors of insect control, are the least amenable to exploitation, since they depend intimately on variable climatic conditions. The most important predators encountered throughout the range studied were Dipterous larvae of the genus *Salpingogaster*. Their efficiency is, however, strictly limited, and little would be gained by transferring species from other countries into Trinidad, where two already occur. It would appear that the froth with which the nymphs of all species of *Tomaspis* are covered is an efficient protection against the attack of most parasites and predators. Similarly, the eggs of most species are well concealed, either in underground parts of the food-plant or in the soil itself. In the case of *T. saccharina* in Trinidad, eggs laid in cane-trash are parasitised to a significantly greater extent than those laid in soil. The only egg-parasite found, except in Trinidad, was an unidentified species from *T. tristis*, F., in Brazil, and the eggs of this froghopper are laid in a relatively exposed position on the leaves of the food-plant.

Recent studies have shown that savannah froghoppers are less uncommon than was formerly supposed. Some species have an extremely restricted range, and it is possible that in the extensive regions of central Brazil similar ones may be present that might repay investigation.

FAJANS (E.) & MARTIN (H.). **The Incorporation of Direct with Protective Insecticides and Fungicides. III. Factors affecting the Retention and Spray Residue of Emulsions and combined Emulsion-Suspensions.**—*J. Pomol.* **16** no. 1 pp. 14–38, 1 pl., 2 figs., 17 refs. London, March 1938.

The following are substantially the authors' conclusions from laboratory experiments in which the examination of the physico-chemical properties that determine the retention of spray fluids and the tenacity of spray deposits [*cf. R.A.E.*, A **24** 225 ; **25** 495] was extended to sprays consisting of emulsions (liquid/liquid systems) and of added suspensions (liquid/liquid/solid systems).

The initial retention (the maximum amount of spray that can be applied without run-off) of emulsions of sufficient stability for practical use is determined by the properties of the aqueous phase and is intermediate between that of the emulsifier solution alone and that of water. The extent of preferential retention of the oil phase increases as emulsifier concentration is reduced and is dependent on the character of the emulsifier. Thus, lime-casein emulsions exhibit preferential oil retention to a greater extent than sulphite lye emulsions of equal stability, a phenomenon that does not appear to be related to the wetting properties of aqueous phase.

The initial and preferential retentions of emulsion-suspension systems are markedly affected by the extent of interaction between the emulsifier and the solid phase. This interaction, which is probably due to chemical reaction between the emulsifier and solid but is not always obvious from chemical data, results in partial or complete adsorption of the oil phase by the solid, which is flocculated to large agglomerates [*cf.* **25** 419; **26** 174]. If no such interaction occurs, the addition of solid has no effect on either the initial retention of the emulsion or free oil retention. Neither has preferential retention of the solid phase been observed in such cases. If interaction occurs, the stability of the emulsion is reduced, with consequent increase in the extent of preferential retention of the oil phase. Preferential retention of the solid phase then becomes apparent. The tenacity of the deposits from emulsion-suspension spray systems is favourably affected by the presence of oil, but may be adversely affected by the emulsifier. With sulphite lye, for example, the adverse effect of the emulsifier outweighs the favourable effect of the oil, which is greater with cottonseed oil than with highly-refined petroleum oil. Owing to the necessity for using, in present spray machinery, sprays of high stability exhibiting but slow separation to layers of varying concentration, only emulsion-suspension systems showing little or no interaction between emulsifier and solid can be recommended for practical use. From this aspect, sulphite lye appears to be most suitable of the emulsifiers examined, and the disadvantages of its unfavourable effect on tenacity may be lessened by a reduction of emulsifier concentration. A comparison of the interfacial tensions between oil and solutions of miscellaneous samples of sulphite lye indicates but small variations in the properties of sulphite lyes from various mills. The reduction of emulsifier concentration in sulphite lye emulsions thus becomes possible in practice. The advantages of emulsion-suspension systems exhibiting interaction and their practicability are discussed.

The main conclusions from the laboratory experiments were confirmed by studies of the copper residues on potato foliage sprayed in the field with cuprous oxide in combination with various oil emulsions.

CHEVALIER (G.) & LAFFOND (P.). **Contribution à l'étude des poudres roténonées.**—*C. R. Acad. Agric. Fr.* **24** no. 10 pp. 380–386. Paris, 1938.

The toxicities of dusts containing different amounts of derris, cubé or rotenone were tested on adults of *Rhaphidopalpa foveicollis*, Lucas, on melon and larvae and adults of *Haltica* [*ampelophaga*, Guér.] on grape vines in Algeria. Determinations were made of the contents of rotenone and other extractives in 13 commercial dusts containing cubé or derris alone or with a diluent. Experiments were arranged to test the toxicity of rotenone (using talc impregnated with a solution of pure rotenone), of derris diluted with talc, and of commercial dusts of known composition. Each powder was tested on 10 larvae and 10 adults in three ways, by rolling the insects in the dust, by dusting them from a distance of 15 cm., and by placing them on powdered foliage. Control insects were treated similarly with pure talc. Mortality varied directly with the content of active material; a dust containing 0·25 or 0·50 per cent. rotenone appeared to be effective, although commercial products usually contain more. Dusts containing plant material were more effective than talc with the same rotenone content, which showed the insecticidal value of the other extractives. The rate of action of the insecticides appeared to be practically independent of the method of application. There was considerable difference in the toxicities of some of the commercial products with nearly the same rotenone contents.

BRYANT (G. E.). **Two new injurious Phytophaga from Nyasaland.**—*Proc. R. ent. Soc. Lond.* (B) **7** pt. 4 p. 88. London, 14th April 1938.

Descriptions are given of the Eumolpid, *Rhembastus coffeae*, sp. n., feeding on coffee stems, and the Galerucid, *Monolepta* (*Candezea*) *gossypii*, sp. n., found on ratoon cotton.

HARGREAVES (H.). **Report of the Senior Entomologist for 1936.**—*Rep. Dep. Agric. Uganda 1936–37* pt. 2 pp. 7–8, 2 refs. Entebbe, 1938.

Infestation by *Nomadacris septemfasciata*, Serv., in the southern and western areas of Uganda continued on a small scale in 1936 [*cf. R.A.E.*, A **25** 351]. Egg-laying, which was apparently delayed by cool wet conditions, occurred early in the year. The resultant hopper bands, although very small in some cases, were larger than in previous years. In populated areas, they were destroyed or dispersed, and only a small proportion of the hoppers reached the adult stage in June ; damage to crops was negligible.

In June and July, some swarms entered Uganda from the south and damaged food-crops, coffee and cotton. Eggs were deposited in October, and also in November, when the first hoppers appeared and caused some further damage.

HARGREAVES (H.) & TAYLOR (T. H. C.). **Report on Investigations of Cotton Stainers** (*Dysdercus* **spp.**) **for 1936.**—*Rep. Dep. Agric. Uganda 1936–37* pt. 2 pp. 9–32, 1 ref. Entebbe, 1938.

Of the four species of *Dysdercus* known to attack cotton in Uganda, *D. nigrofasciatus*, Stål, is usually the commonest and occurs throughout the cotton-growing areas. *D. superstitiosus*, F., is also widely distributed, but is more abundant in the drier areas of the north and east, and occurs on cotton less regularly. *D. fasciatus*, Sign., is much more erratic in incidence, both in time and place, and is thought to be a comparatively recent immigrant from the drier areas to the north and east, its spread having followed that of cotton. *D. cardinalis*, Gerst., appears to be confined to the drier areas and is often common at the end of the cotton season, but almost always less so than the first two species.

In the field, all these species deposit their eggs in the soil in sheltered places, often at considerable distances from the food-plant, or bury them in exposed heaps of cotton-seed. In laboratory studies on the bionomics there were few marked differences between the species. The durations of the egg and nymphal stages and the preoviposition period varied from 5 to 9, 26 to 36 and 6 to 11 days, respectively. The sexes occurred in approximately equal numbers, but in the field the males were the more abundant. The first batch of eggs laid by any female was usually the largest. The maximum number recorded in any one batch was 154 and the total for a single female 909. Excluding the individuals killed by disease, the mean lengths of life of males and females in days were, respectively, 65 and 62 for *fasciatus*, 71 and 62 for *nigrofasciatus*, and 91 and 43 for *superstitiosus*. Unpaired individuals usually gave higher maxima. Inter-specific pairing has been observed in the field, but when it occurred under laboratory conditions the resulting eggs were not viable.

In experiments on the influence of relative humidities ranging from 30 to 90 per cent. (with uncontrolled temperatures) on the immature stages of *superstitiosus*, *fasciatus* and *nigrofasciatus*, all the fertile eggs developed normally, but at 30 per cent. none hatched, although apparently normal nymphs were present within them. The minimum humidity required for the maximum percentage of hatching was 70 per cent. At 50 per cent., all nymphs of *superstitiosus* and *nigrofasciatus* died in the first instar, but a few of *fasciatus* reached the second ; at 70 per cent. several nymphs of the first two species and many of the third reached the second instar ; and at 75 per cent. all did so. In all three species, the rate of development of first-instar nymphs increased with the humidity. They do not feed, but remain massed together in the cavity in which the eggs were deposited. The second-instar nymphs make their way to the surface of the soil and disperse. They can survive for many days without food, moult, and occasionally reach the fourth instar, provided that there is sufficient moisture.

Adults of *superstitiosus* that were fed on cotton-seed for a few days before being starved lived for a maximum of 33 days when kept in separate tubes with water only, but without food or water they died within 3 days. Although in dry weather they visit the flowers of a great variety of plants, they only utilise them as sources of moisture. Thus, in the field, only long periods of drought are fatal to them in bulk, and some will survive a drought of normal seasonal duration even though breeding may be impossible. Of about 70 nymphs given water and green half-grown bolls for food, only five reached the fifth instar, and three became adult; the duration of the nymphal stage was 62–77 days in contrast to 30–35 days for nymphs fed on cotton-seed in otherwise similar conditions. When *nigrofasciatus* was fed in the fifth instar and adult stage on green bolls and water, the average pre-oviposition period was 15 days, as compared with 8 days for controls fed on cotton-seed and water, while the total numbers of eggs deposited averaged 282 and about 850, respectively. These experiments support field observations showing that *Dysdercus* cannot multiply appreciably until the cotton plants begin to bear ripe bolls.

In Uganda, these cotton stainers breed on many plants of the families Malvaceae, Bombacaceae and Sterculiaceae. A list is given, in order of preference, of the food-plants of *nigrofasciatus*, and others are discussed on which the common species of *Dysdercus* were formerly thought to feed. Nymphs are able to reach the fifth instar on *Pavonia kraussiana*, *Melhania ferruginea* and *Triumfetta* spp., but never become adult. The most common and widely distributed food-plants, excluding cotton, of the genus as a whole are *Wissadula rostrata, Hibiscus micranthus, H. calycinus, H. asper* and *H. cannabinus* in dry districts, and *H. diversifolius, H. macranthus* and *Abutilon indicum* in wetter areas. In the field, *superstitiosus, cardinalis* and *fasciatus* are not attracted to so great a variety of plants. Laboratory experiments indicate that while the seeds of cotton and kapok are the most suitable for all species (all four developing at the same rate on both), many other plants are more suitable for *nigrofasciatus* and *superstitiosus* than for *fasciatus* and *cardinalis*. In the drier districts, the environment of the various food-plants appears to determine to a great extent which species of *Dysdercus* attacks them ; *superstitiosus* occurs mainly on species with a short fruiting period in exposed situations (*H. asper* and *H. micranthus*), whereas *nigrofasciatus*, although common on exposed plants, appears to prefer species with a much longer fruiting period that grow in shaded, sheltered situations (*H. calycinus* and *W. rostrata*). As a result, *superstitiosus* is compelled to migrate at frequent intervals as its food-plants dry up, while *nigrofasciatus* is able to breed more continuously without migration. This probably explains why, in the drier areas, the former is more common on cotton early in the season, although the latter predominates later. In the cooler, wetter districts, these differences are much less apparent.

At the end of 1936–37, *superstitiosus* was more prevalent than *nigrofasciatus* in the north-west, and *cardinalis* commonly occurred. In this area, herbaceous Malvaceae are uncommon, and the stainers are therefore more dependent upon arboreal food-plants than in other parts of Uganda. *Sterculia cinerea*, the principal wild food-plant of *cardinalis*, was fairly common ; *superstitiosus* bred abundantly upon it, but it very rarely harboured *nigrofasciatus*. All three species also bred on kapok, but as it does not fruit at the same time as *S. cinerea, superstitiosus* is able to breed more abundantly than *nigrofasciatus*. It is probable that *cardinalis* and *fasciatus* are mainly arboreal. The latter is very rare, as it flourishes only in areas where *Sterculia* spp. *Thespesia* spp., and *Adansonia* (baobab) are common and provide, with or without cotton, a constant food-supply throughout the year ; occasionally, however, it establishes itself in isolated localities, breeding almost entirely on cotton and particularly on cotton-seed dumps near ginneries and stores.

In the early part of the cotton season, during the first rains and the succeeding dry period, the stainers occur chiefly on wild plants and cotton-seed dumps, but are checked by the Tachinid, *Bogosiella fasciata*, F., and fungi. In the hotter drier districts, probably on account of lack of moisture, a few of the stainers migrate from the wild plants just before the beginning of the second rains and a large population may then develop on cotton. When very dry weather is followed by an unusually prolonged wet season, multiplication may be abnormally extensive. In cooler, wetter districts, the migration from wild plants at this time is very slight. In the dry weather after the second rains, the adults begin to migrate from the cotton again because of lack of moisture. This movement is later increased by the general uprooting of the cotton ; and as breeding is still impossible, a heavy mortality occurs. When the insects do not migrate from the wild plants until the latter have died back, conditions prevent extensive breeding on cotton and the population remains low. The earlier migrants, though less numerous, are, therefore, a much greater menace than the later ones.

The parasite, *B. fasciata*, is commoner in wetter districts than in dry ones. It attacks *superstitiosus*, *nigrofasciatus*, *fasciatus*, *ugandanus*, Schout., and probably other species of the genus. The eggs are deposited singly, preferably on adults ; nymphs are often attacked when they outnumber the adults, but development in them is slower. The larva bores straight into the host and makes its way into the body-cavity. Normally only one parasite matures in each host, though two occasionally do so. In the field, a maximum of 15 eggs per host has been found. Parasitised females usually oviposit normally once after being attacked, but subsequently oviposit very little, although feeding and pairing continue. The full-fed larva leaves its host through the anal opening and pupates in the soil. The host may survive for as long as 3 days afterwards. Considerable moisture is necessary for the development of the pupa ; this suggests that the Tachinid, like its hosts, can multiply only in wet weather. In the laboratory, with adult hosts, in June 1936, the egg, larval and pupal stages lasted 3, 13–16 and 13–17 days, respectively. In May, June and July 1936, parasitism of stainers on wild plants near Kampala seldom fell below 40 per cent. and was sometimes 100 per cent., but it seldom exceeded 2 per cent. in stainers on exposed stored cotton-seed and cotton-seed dumps. In January, February and March 1937, the percentage parasitism of adult stainers collected from cotton in the same area was only 9, 2·5 and 5, respectively.

In May and June 1936, adults of *nigrofasciatus* were parasitised by an unidentified Sarcophagid [*cf. R.A.E.*, A **25** 324], which, however, possibly attacks them only when they are diseased or dying, and nymphs and adults of three species of *Dysdercus* were killed by the fungus, *Entomophthora sphaerosperma*.

In conclusion, the authors point out that, in some areas, the presence of a continuous litter of cotton-seed in and near ginnery compounds is an important factor in maintaining a seriously high population of cotton stainers during the close season for cotton. Moreover, the breeding of the insects on diseased seed may be of considerable importance in carrying over infection by the staining fungus (*Nematospora*) from one season to another. Cotton-seed dumps are serious sources of infestation, and their destruction, or dry weather, causes widespread dispersal of the stainers on them. There should, therefore, be a weekly clearance of all seed sufficiently exposed to be damp, and of all weeds liable to shade it. To avoid building up a large population of stainers, rapidly maturing varieties of cotton should be grown and the sowing season should be restricted to a period of 4 months in at least the wetter districts. It is thought that this would give additional yields without incurring reduction of the areas sown. Open bolls should not be left in the field longer than is necessary for their full maturation. In cotton plots on recently cleared land, tree stumps that have been left may sprout and produce low bushes with dense foliage, under which the soil remains damp in dry weather and is therefore available for breeding. These bushes should be systematically cut down, so that there is no deep shade in or very close to the cotton plots. Collecting and destroying the bugs weekly for six successive weeks from the ripening of the earliest bolls will largely prevent the rapid breeding on ripe cotton-seed possible during wet weather.

Gwynn (A. M.). **Report of the Entomologist, Serere, 1936–37.**—*Rep. Dep. Agric. Uganda 1936–37* pt. 2 pp. 33–39, 1 ref. Entebbe, 1938.

In further experiments on the differences in varietal susceptibility of cotton to infestation by Jassids [*cf. R.A.E.*, A **25** 352], there was no indication that these insects are a pest of any importance in Uganda. There was a marked tendency for them to congregate on the more susceptible varieties, and these showed correspondingly more severe symptoms. Infestation by *Lygus* [*simonyi*, Reut.] was, as usual, serious during the first half of the season, but ceased to be of any importance after September. Spraying with an arsenic-sugar bait or tobacco decoction and soap, and dusting with pyrethrum did not reduce infestation sufficiently to affect the yield significantly. Varietal tests gave no indication of any differences in susceptibility. *Helopeltis* [*bergrothi*, Reut.] was rather prevalent in most of the districts east of the Nile. Estimates of infestation confirmed the differences in varietal susceptibility found previously [**25** 353].

The *Dysdercus* population on wild plants was small, and the adults invaded the cotton late and in very small numbers. Breeding was prevented by dry weather during the greater part of November and October, but was stimulated by heavy rain in December, when there was apparently a further influx of stainers. From the beginning of December to mid-February, the population increased from 100 to 4,000 adults per acre. Examination of bolls collected just when they were beginning to split showed that staining due to *Nematospora* introduced by *Dysdercus* was negligible and that much of the staining was not obviously associated with insect punctures. Both *Argyroploce* [*leucotreta*, Meyr.] and *Earias* were very abundant, and the latter caused extensive shedding of buds and young bolls in September and October. The damage by both species is out of all proportion to the number of larvae found in the bolls, for the young larvae often bore into the boll walls but do not remain there. Their burrows, however, allow fungi and bacteria to enter the lint cavity and cause more or less extensive rotting.

Taylor (T. H. C.). **Pink Boll Worm** (*Platyedra gossypiella*, **Saund.**).—*Rep. Dep. Agric. Uganda 1936–37* pt. 2 pp. 40–42, 1 ref. Entebbe, 1938.

Observations in 1936–37 on the distribution of *Platyedra gossypiella*, Saund., in Uganda [*cf. R.A.E.*, A **25** 353] showed that it is spreading to the east and south ; although it has not yet been found south of Masaka Township, it is believed that it extends to the Tanganyika border. Larvae that were artificially induced to enter the resting stage in January 1936 [*cf.* **25** 355] gave rise to adults from July to December. In February 1937, in the north-west, seed-cotton picked from a very heavily infested plot was spread on a mat to dry in hot sun with, probably, an abnormally low humidity. Of 50 larvae taken from the mat and kept in a bag of seed-cotton, 30 had entered the resting stage in 10 days, while in a control sample from bolls on the plants all had pupated. Some of the resting larvae were in double seeds, which were the first seen by the author in Uganda ; only these larvae are able to survive ginning. Since they are in picked cotton, almost all of them are taken to the ginneries, and it is therefore only in the neighbourhood of ginneries that they can affect the degree of infestation in the following season. There is only one ginnery for the whole of the West Nile district, and the infestation in its immediate vicinity is very severe every year. Although the available evidence suggests that this is due to the cotton plants not being thoroughly destroyed at the end of the season, it now appears that resting larvae may be a contributing factor. Most of them, however, give rise to moths when the next season's cotton is being planted, and lack of food-plants then prevents breeding. It is concluded that the resting stage will never be of importance in Uganda, except under very unusual weather conditions, and that in the wetter and cooler parts of the country it cannot occur at all.

In 1936–37, the average percentage infestation remained low, and damage to the crop as a whole was very slight. There is, however, a very small margin of safety and more thorough destruction of old cotton is still desirable in the north-west. Appreciable damage results in many localities, although not over large areas, from a succession of plantings of cotton in adjacent plots; these provide excellent conditions for the building up of the *Platyedra* population.

WICKENS (G. M.). **A new and serious Disease of Tobacco in S. Rhodesia. Preliminary Note.**—*Rhod. agric. J.* **35** no. 3 pp. 181–184, 1 pl. Salisbury [S. Rhodesia], March 1938; also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 1063, 4 pp., 1 pl.

The symptoms of a disease of tobacco that was first observed in Southern Rhodesia in 1936–37 and caused serious loss of crop in some fields are described and illustrated. From preliminary observations and experiments, it would appear to be due to a virus that has not hitherto been recorded, and to be transmitted by the Aphid, *Myzus persicae*, Sulz. It is not mechanically transmissible by handling.

STOFBERG (F. J.). **The Biology of the Citrus Mussel Scale** (*Lepidosaphes pinnaeformis* (**Bouché**) **Kirk.**).—*Sci. Bull. Dep. Agric. S. Afr.* no. 165, 29 pp., 11 figs., 10 refs. Pretoria, 1937. Price 3*d*.

The results are given of investigations on the bionomics of *Lepidosaphes pinnaeformis*, Bch., on *Citrus* in the eastern Transvaal. This Coccid is second in importance to red scale [*Aonidiella aurantii*, Mask.] as a pest of *Citrus* in South Africa, but causes serious damage only in the eastern Transvaal, the Swellendam district in the south of Cape Province, the Natal mist district and Portuguese East Africa. It occurs on all the commercial varieties of *Citrus*, and also on *Croton*, *Coleus* and *Murraya*. The scales usually congregate on the lower and inner branches, and in severe cases the leaves and fruit may be completely encrusted. As a result the leaves turn yellow, whole branches may be practically defoliated and are often killed, and ripening fruits are spotted with green and are so firmly encrusted with the insects that these cannot be removed except by hand-brushing.

Investigations on the life-history of this Coccid, mostly in 1933, were made in an open insectary, on small sweet-orange plants in pots. Records of infestation were taken over a period of several years. Individual leaves were isolated by covering the petiole first with paraffin wax and then with an adhesive. Observations showed that in the majority of individuals, the incubation period lasted about 14 days in summer and 3–4 weeks in winter. Without food, few of the newly emerged larvae survived for more than 36 hours and none for more than about 48. They did not wander far from the parent. In experiments, their rate of movement increased with temperature, and at the highest tested (83°F.) a larva crawled 123½ inches on smooth paper in 2 hours. Others on fine sand were unable to make much progress. They are, however, easily carried from tree to tree by wind, and are also distributed by birds and insects. Most of them settle about 24 hours after emergence, infesting first the leaves and branches, and then, if the population increases, the fruit. Of a total of 2,100 larvae liberated during different months of the year, 75 per cent. settled, giving a 25 per cent. mortality of crawlers. Of 1,935 liberated in 1933, 61·7 per cent. became adult, the mortality for the winter and summer months being, respectively, 43·5 and 36 per cent.

Both sexes had two larval instars, the first moult occurring 14–19 days after settling, and the male passed through a prepupal and a pupal stage. After becoming adult, it remained under the scale for about 6 days, eventually emerged about 53 days after hatching, and paired, dying apparently within 24 hours. The shortest developmental period recorded was 32 days in summer, and the longest 90 days in winter. The female moulted for the second time about 45 days after hatching. Pairing took place about 8 days later, and was followed by a preoviposition period of about 10 days in summer and 23 in winter. Parthenogenesis did not occur in any of the experiments. The maximum number of eggs laid by any one female was 264. Records are given of the daily emergence of larvae; the maximum number was 10, and 7 and 9 commonly occurred. The total number of larvae produced by one female varied from 61 to 191 in summer and 78 to 264 in winter, and the lengths of the emergence period were 56–94 and 113–212 days, respectively. Of 1,780 young produced by 21 females, 73·2 per cent. were males. The life-cycle was completed in about 2½ months in summer and 4 in winter, and records, tabulated in detail, show that four generations and possibly a partial fifth occur during the year, but that there is considerable overlapping in the field. In the first hot weather in September, the population increases considerably and breeding continues until March, after which the rate of development and reproduction is considerably retarded.

Where control measures were not carried out regularly, 30–40 per cent. of *L. pinnaeformis* in the low veldt of the eastern Transvaal were parasitised by *Aspidiotiphagus citrinus*, Crwf. The egg is deposited in the second-instar larva of the host, and the adult parasite eats its way out through a hole in the dorsal scale. Parasitism was, however, not constant or high enough to give reliable control. A parasitic fungus in Natal was identified as *Tetracium rectisporium*. Two Coccinellids of the genus *Chilocorus* are predacious on the scale, but are not of much practical importance.

The only related scale of economic importance on *Citrus* in the eastern Transvaal is *Lepidosaphes gloveri*, Pack., which is usually found together with *L. pinnaeformis*. Characters are given by which the two species may be distinguished. Possible control measures are briefly reviewed.

The House Longhorn Beetle.—*Leafl. For. Prod. Res.* no. 14, 5 pp., 3 figs. Princes Risborough, Aylesbury, Bucks., January 1938.

Although an important pest of seasoned softwood timbers on the Continent, *Hylotrupes bajulus*, L., has only rarely been responsible for serious damage to building timbers in Great Britain. Several cases of infestation have, however, been observed during the past 3–4 years, and every effort should be made to check its further spread, as, once it is established, control is extremely costly and eradication probably impossible. A brief account is given of the bionomics of this Cerambycid, and the adult, larva and damage are described and illustrated. Treatment includes removal of infested wood, application of insecticides and sterilisation of timber *in situ* by dry heat.

DAVIES (W. M.) & WHITEHEAD (T.). **Studies on Aphides infesting the Potato Crop. VI. Aphis Infestation of isolated Plants.**—*Ann. appl. Biol.* **25** no. 1 pp. 122–142, 8 refs. Cambridge, February 1938.

The following is substantially the authors' summary of this account of continued investigations in Wales in 1935–36 of *Myzus persicae*, Sulz., on potato [*cf. R.A.E.*, A **24** 551, etc.] : The investigations were planned to ascertain the extent of the migrations of the winged Aphids, their ability to detect individual plants, the development of Aphid populations following colonisation, and the extent to which virus diseases may be transmitted to isolated plants by winged Aphids [*cf.* **24** 61]. Potato plants were isolated in fields of mangels on seven farms and at varying distances from probable sources of virus infection. Four farms were in districts where the Aphid population is usually high, and viruses spread very rapidly, two in districts where both Aphids and spread of viruses are minimal, and one could be regarded as intermediate in both respects.

Evidence is submitted to show that winged Aphids have no difficulty in detecting and colonising isolated plants [*cf.* **25** 388]. Their numbers were large at the four eastern centres and very small at the three western centres. In all cases, the Aphid population on isolated plants was less than that of the nearest general crop and suffered more from predators and parasites. It is shown that isolated plants can be reached by migrants from a distance of at least a quarter of a mile and probably much further. Additional evidence is given that these initial migrants introduce little virus infection to potato crops from extraneous sources. The importance, however, of the later movements of winged Aphids, whether initial migrants or those subsequently produced on potatoes, in spreading viruses from crop to crop is emphasised.

The practical aspects are discussed of protecting potato stocks under conditions of heavy or slight infestation by winged Aphids where numerous sources of virus infection occur in neighbouring crops, and under conditions where Aphids and sources of infection are both scarce. It is suggested that these various conditions should be considered in regulations for the improvement of health in seed potatoes.

RIVNAY (E.). **Factors affecting the Fluctuations in the Population of** *Toxoptera aurantii* **Boy. in Palestine.**—*Ann. appl. Biol.* **25** no. 1 pp. 143–154, 4 figs., 1 ref. Cambridge, February 1938.

An account is given of investigations in Palestine in 1934–37 on the influence of temperature on *Toxoptera aurantii*, Boy., on *Citrus*. This

Aphid is numerous in the spring and attacks young growth [*cf.* *R.A.E.*, A **25** 643], but generally causes little damage. Occasionally, however, it attacks the blossom shoots, causing the blossoms to fall. Apterous and alate females are present and reproduce parthenogenetically throughout the year. There is no sexual reproduction, and in the investigations no sexual oviparous females were observed. Examples of an additional alate form, apparently the male, were, however, found in the course of breeding.

In the laboratory on twigs of *Citrus*, the life-cycle of the apterous females lasted only 6–7 days at 22–25°C. [71·6–77°F.] and high relative humidity, and this temperature was also the most favourable for reproduction. It was longer at higher or lower temperatures, averaging 9 days at 18–22°C. [64·4–71·6°F.] and 3 weeks at 15°C. [59°F.]. At 22°C., the maximum number of young produced per female in a day was 8, and the average total production was about 70. Below 13°C. [55·4°F.] and above 33°C. [91·4°F.], only 1 per day was produced. Of 121 Aphids reared at 30–32°C. [86–89·6°F.], only 4 became adult ; they were undersized and did not reproduce. Changes in humidity had little effect when the temperature was optimum and the food-supply good. At higher temperatures, a low relative humidity lowered the thermal death-point.

The population of *T. aurantii* on the young growth of *Citrus* increases towards the end of February and in March, when the day-temperatures are optimum, and decreases suddenly in April, when the temperature sometimes reaches 40°C. [104°F.]. This decrease generally occurs before blossoming. Slight re-infestations may recur during mild weather in summer ; otherwise, the Aphids are practically absent until the autumn.

Graphs show the temperature for December and January in 1935 and 1936, and the variation in the Aphid population in relation to temperature and the phenology of *Citrus* trees. It is concluded that if the daily maximum temperature during December and January exceeds 18°C., infestation will be serious in the ensuing March, and trees should be sprayed in February with nicotine sulphate (1 : 800 or 1 : 1,000).

FISHER (R. C.). **Studies on the Biology of the Death-watch Beetle, *Xestobium rufovillosum* DeG. II. The Habits of the Adults with special Reference to the Factors affecting Oviposition.**—*Ann. appl. Biol.* **25** no. 1 pp. 155–180, 6 figs., 12 refs. Cambridge, February 1938.

This second paper of a series [*cf.* *R.A.E.*, A **26** 34] comprises an account of recent investigations in Buckinghamshire on certain aspects of the bionomics of *Xestobium rufovillosum*, DeG.

The earliest date on which pupae were observed in decayed willows in the field was 18th July. They were numerous in August and persisted into early September. The pupal period lasted 3–4 weeks. Some adults emerged from the wood in the succeeding April, but the majority did not do so until May. The average temperature at the time of the maximum emergence was 10–12°C. [50–53·6°F.]. The development of the reproductive organs during hibernation is described. Males are sexually mature on emergence, and females are rapidly becoming so.

Examination of timber from infested buildings, unheated or only intermittently heated in winter, also showed that pupae were present during August and September. Emergence of adults in buildings has been recorded from mid-March, but the majority were observed in April–May, when the outside temperature was about 10°C. In the laboratory, pupation occurred at any time of the year, depending on temperature and humidity. At 23·9 and 22·7°C. [75·02 and 72·86°F.] and relative humidities of 89 and 90 per cent., the pupal stage lasted 16 and 18 days, respectively.

In the field, adults are most active and pair from 4 to 6 p.m. They do not fly from building to building, though capable of using their wings, but may crawl considerable distances. The processes of tapping with the frons, pairing and oviposition are described. The eggs were deposited singly or in small batches in cracks, among broken fibres of wood, in the frass of old larval tunnels and on roughened surfaces, and the larvae were able to crawl to a place suitable for boring. Under natural conditions in the open, females deposited 39–201 eggs, the usual number being 40–60, beginning 8–13 days after pairing. Females lived up to 10 weeks after pairing, and males 8–9, but neither survived after the beginning of July. The egg stage lasted 3–5 weeks, depending on temperature; mortality averaged about 5 per cent.

Under laboratory conditions, an increase in temperature during May resulted in earlier oviposition, and females taken from their pupal chambers in trees in August and September and exposed to temperatures of 25 or 20°C. [77 or 68°F.] and 86 per cent. relative humidity oviposited in November and January, respectively. At constant temperatures between 15 and 30°C. [59 and 86°F.], the oviposition period increased with the relative humidity, accompanied at the higher humidities by a greater number of eggs per female. An increase in temperature shortened the oviposition period, but up to 20°C. increased the number of eggs per female. If the humidity also increased, the number of eggs became greater up to 25°C., and then decreased. At 15–20°C., the duration of adult life was about 7–9 weeks for females and 5–7 weeks for males. It was prolonged by an increase in the humidity.

Changes in relative humidity above 41 per cent. had little effect on the rate of development of eggs kept at 15, 20, 25 and 30°C., but at 23 per cent. none hatched. No eggs hatched at 30°C. and at 25° the egg stage lasted 2 weeks. The latter temperature probably approaches the optimum. The threshold of development lay between 10 and 15°C.; at 15° the egg stage lasted about 7 weeks, whereas eggs kept at 10° did not hatch in 8 weeks, but completed development when transferred to 20°C.

"Indices of suitability" are given for various combinations of temperature and humidity in relation to oviposition and hatching. They are obtained by the formula $NV \div (L+T)$ where N and V are the number and viability of the eggs laid and L and T are the durations of the oviposition period and egg stage, respectively.

The author's practical conclusions are that warm dry conditions are less favourable for the spread of infestation during egg laying than warm moist ones, which may be localised in structural timbers as the result of a leaking roof or imperfect guttering. The slow progress or even cessation of attack may be explained by high temperatures associated with fluctuations in humidity in confined spaces in roofs leading to low egg production and high egg mortality.

Thomas (I.). **On the Bionomics and Structure of some Dipterous Larvae infesting Cereals and Grasses. III.** *Geomyza* (*Balioptera*) *tripunctata* **Fall.**—*Ann. appl. Biol.* **25** no. 1 pp. 181–196, 10 figs., 9 refs. Cambridge, February 1938.

This paper, which is one of a series [*cf. R.A.E.*, A **22** 545, etc.], comprises an account of observations in Lancashire and East Anglia on *Geomyza* (*Balioptera*) *tripunctata*, Fall., the egg, larva and puparium of which are described in some detail. The adult has frequently been confused with that of *G. combinata*, L., which it closely resembles.

Adults of *G. tripunctata* were present on grasses from mid-March to the end of November, and third-instar larvae were found throughout the winter in rye grass (*Lolium italicum* and *L. perenne*), *Dactylis glomerata*, *Poa trivialis*, *P. annua* and wheat. They occurred frequently together with larvae of *Oscinella frit*, L., in *L. perenne* [*cf.* **19** 51], causing the central shoots of the tillers to wither. The percentage of tillers attacked did not usually exceed 4–5. There are probably 2 generations a year ; first- and second-instar larvae were common in May and again in August–October. Pupation took place in February–March. Some puparia do not give rise to adults in the spring or summer following pupation.

In the laboratory, eggs were deposited in the stem of the food-plant, generally only one per plant. The majority were laid at or below ground-level, but a few were found up to a height of 2 ins. The larva penetrated to the base of the shoot and fed until the shoot was severed. Pupation occurs within the shoot. The three larval instars and the pupal period lasted 5–8, 2–4, 9–15 and 17–30 days, respectively. The preferred food-plants, in order of preference, were *L. perenne*, *L. italicum*, wheat, barley, *P. trivialis*, *D. glomerata*, *Cynosurus cristatus*, oats and *Festuca rubra*. The Braconids, *Phaenocarpa livida*, Hal., and *Chasmodon apterus*, Nees, and a Pteromalid of the genus *Stenomalus* were bred from the puparia.

Edwards (E. E.). **Field Investigations upon the Control of the Mustard Beetle,** *Phaedon cochleariae* **F., on Watercress.**—*Ann. appl. Biol.* **25** no. 1 pp. 197–205, 1 pl., 3 refs. Cambridge, February 1938.

In view of the fact that flooding watercress beds for the control of *Phaedon cochleariae*, F., has not proved satisfactory, experiments were carried out in England in 1935 with derris and pyrethrum insecticides [*cf. R.A.E.*, A **21** 396]. Those tested comprised a derris wash containing 0·004 per cent. rotenone with 0·05 per cent. sulphonated lorol as a spreader, two derris dusts with respective rotenone contents of 0·2 and 0·5 per cent., and a pyrethrum emulsion containing 0·01 per cent. pyrethrin I. Two applications were made, on 24th June and 5th July, respectively, on plots of uniformly heavily infested watercress. Counts were made on 10th July, the weather in the interim having been warm and sunny. The treatments described reduced the beetle population to an average of 22·4, 13·7, 3·1, and 37·9 per cent., respectively, of that on the control plots, which averaged 322 individuals per sq. ft.

The control given by the second derris dust is considered very satisfactory, but there would be several disadvantages attendant on an indiscriminate use of derris dusts in the beds. These include the danger of poisoning fish in rivers or ponds to which the dust might be carried, and the practical difficulty of ensuring a thorough application to the lower leaves, where the beetles congregate in dull weather.

These experimental results were confirmed by growers in South Wales and Monmouthshire in 1936, who obtained sufficiently good control with a derris dust of not less than 0·2 per cent. rotenone content applied at intervals of 10 days during sunny weather.

MILES (H. W.). **The Wireworm Problem.**—*Ann. appl. Biol.* **25** no. 1 pp. 211–214. Cambridge, February 1938.

Reference is made to investigations now in progress in England on the control of wireworms. These include mechanical processes of cultivation and crop rotation in Lancashire and Cheshire, fumigation at Rothamsted, where carbon bisulphide, crude naphthalene and a sodium cyanide mixture have given good results, and variations in the methods of cultivating sugar-beet in infested fields at Cambridge, where drilling wheat between the rows of beet gave a good increase in the number of plants.

Botley Experimental Fruit Station. Report on Experiments on Strawberries, 1923–1937.—66 pp., illus. Winchester, Hants agric. Educ. Comm., 1938. Price 6*d*.

This report on work in 1923–37 on strawberries in Hampshire contains a section by W. E. H. Hodson and C. J. Gleed on investigations on pests and diseases (pp. 47–63). *Anthonomus rubi*, Hbst., is one of the most serious pests ; notes on its bionomics are given [*cf. R.A.E.*, A **19** 611], and the relative susceptibility of certain varieties of strawberry is discussed. Burning off the beds directly after picking to destroy the newly emerged adults has been found of no value ; nor does it affect any other pest with the possible exception of *Tetranychus telarius*, L. Difficulties preventing control by sprays and dusts are discussed ; the only promising one, a foreign proprietary dust, containing 8 per cent. arsenic, gave about 85 per cent. control, but it is not recommended, as ripe fruit from plots dusted with it showed an arsenic content of 2·15 parts per million, whereas the tolerance for foodstuffs is 1·43 parts.

Brief notes are given on the biology of *Capitophorus fragariae*, Theo. [**26** 103] and its association with virus disease [**25** 665, etc.]. The hot-water treatment of runners [**22** 234, 582] has solved the problem of obtaining uninfested planting material, but there is still no known method of protecting established plantations from outside infestation.

Tarsonemus pallidus, Banks, first observed at the station in 1931, has become the most important pest of strawberries in south Hampshire ; its life-history and the damage it causes are briefly described, but despite numerous experiments, no control in infested beds has been achieved. Hot-water treatment of runners over large areas should provide a reasonable chance of fruiting over a satisfactory period, as reinfection takes place comparatively slowly.

Of Curculionid larvae attacking the roots, the three most important are *Otiorrhynchus sulcatus*, F., *O. rugostriatus*, Goeze [*cf.* **25** 71], and *Sciaphilus asperatus*, Bonsd. (*muricatus*, F.) ; preliminary control experiments indicate that further investigation is needed before measures can be recommended. Very brief notes are given on a few minor pests and on 11 Carabids observed in strawberry beds. Some of these Carabids are predacious on the larvae of the root weevils, but others, notably *Harpalus rufipes*, DeG. (*Ophonus pubescens*, Müll.) cause damage to the strawberry fruits. Experiments on the hot-water treatment of strawberry runners over a number of years are described and the crop records tabulated. In general, the treated plants have been markedly superior to untreated ones, but have eventually become re-infested by pests from adjacent plantations.

Della Beffa (G.). **Il controllo fitopatologico nella esportazione delle castagne dal Piemonte verso gli Stati Uniti d'America nella campagna 1937–1938.** [Phytopathological Examination of Chestnuts exported from Piedmont to the United States in the Season 1937–38.]—*Boll. Lab. sper. R. Oss. Fitop. Torino* **14** (1937) pp. 77–81. Turin, 1938.

The greater part of this report on the inspection in Piedmont in 1937–38 of chestnuts for export to the United States is devoted to fungous pests. The insect pests recorded were the larvae of *Cydia* (*Carpocapsa*) *splendana*, Hb., *C. splendana* var. *reaumurana*, Hein., and a species of *Curculio* (*Balaninus*) [*cf. R.A.E.*, A **22** 533].

Service and Regulatory Announcements, October–December 1937.—*S.R.A., B.E.P.Q.* no. 133 pp. 257–318. Washington, D.C., U.S. Dep. Agric., March 1938.

An announcement (B.P.Q. 359 supplement no. 2) relating to Quarantine no. 48 against the Japanese beetle [*Popillia japonica*, Newm.] in the United States modifies instructions for the use of paradichlorobenzene for treating soil round roots of certain plants [*R.A.E.*, A **24** 258]. The method of treatment [*loc. cit.*] remains unchanged, but it may be applied to a number of plants of various genera (the names of which are given). During fumigation, the soil balls round the roots may not now be more than 6 ins. in diameter. The periods of exposure required for soil balls of three diameters (up to 2, 2–4, and 4–6 ins.) are given in a table; they vary from 1 to 10 days according to the temperature and the amount of fumigant used (1–20 lb. per cu. yard surrounding soil). Supplement no. 3 to B.P.Q. 359 authorises the movement of strawberry plants fumigated with methyl bromide at the rate of 3 lb. per 1,000 cu. ft., including the space occupied by the plants, for a period of 4 hours, the plants and room to be at a temperature of not less than 60°F. during this period. The treatment must be applied under official supervision in an approved fumigation chamber, and the strawberry plants must be piled loosely in open crates or baskets and stacked so that the gas mixture can have access to all sides of the container. After the room is filled and closed, the methyl bromide is volatilised within the room and the mixture of gas and air circulated by means of a fan or blower throughout the entire 4-hour fumigation period.

An announcement (B.E.P.Q. 436, revised) relating to Quarantine no. 61 against the thurberia weevil [*Anthonomus grandis thurberiae*, Pierce] provides that permits will be issued for the inter-state movement of cotton-seed after treatment by any of three methods, one of which is already in force [**26** 134], while the other two are treatments already approved under Quarantine no. 52 against *Platyedra gossypiella*, Saund. [**26** 229].

Other matter in this part includes summaries of plant-quarantine restrictions issued by Haiti, St. Lucia, Fiji and French Colonies; as well as amendments to summaries already noticed of restrictions issued by Poland, Finland, Norway, Jugoslavia, Egypt, Morocco, Cuba, Argentina, Barbados and the Netherlands East Indies.

BISHOPP (F. C.). **Entomology in Relation to Conservation.**—*J. econ. Ent.* **31** no. 1 pp. 1–11. Menasha, Wis., February 1938.

In this presidential address on the relation between insects and the conservation of natural resources, the subjects discussed include the destruction of cover leading to soil erosion, forest defoliation and its effect on rainfall and floods, the destruction of timber by bark-beetles and consequent increased danger of forest fires, insect depredations in forest nurseries, the effect of changes in the flora of overgrazed ranges on the abundance of injurious insects and the possibility of the restoration of desirable plants in such ranges by insect control of undesirable growth, the danger of intensifying entomological problems by withdrawing unprofitable lands from agriculture, the advantages and disadvantages of clean culture, strip planting and water conservation, the effect of burrowing insects on the soil, crop rotation, the favourable and adverse influences of insects on the conservation of wild life, and the devitalising effects of insecticidal deposits on the soil.

Symposium of the Relationship between Insects and Plant Diseases.—*J. econ. Ent.* **31** no. 1 pp. 11–44, many refs. Menasha, Wis., February 1938.

This symposium consists of five papers and discussions on three of them. In the first: Insects in Relation to Diseases of Truck Crops (pp. 11–18), A. A. Granovsky discusses external and internal structures of insects that adapt them to transmitting pathogenic organisms and outlines the various ways in which insects spread, or assist in spreading, plant diseases. He then gives notes on various fungous, bacterial and virus diseases of vegetable crops and the insects that spread them, and on the disease-like injuries caused by the feeding of certain sucking insects.

L. O. Kunkel, in a paper entitled Insects in Relation to Diseases of Fruit Trees and small Fruits (pp. 20–22), confines himself, after pointing out the distinction between viruses that do or do not require an incubation period in the insect vector, to a study of *Macropsis trimaculata*, Fitch, and its relation to peach yellows and little peach, two diseases thought to be due to strains of the same virus, which belongs to the former class. Notes are given on the habits of the leafhopper [*R.A.E.*, A **26** 173]. During three summers, considerable numbers of nymphs and adults were collected from trees with little peach in New Jersey and confined on young trees in cages in greenhouses, but only in a few cases early in the season was the disease transmitted. In no case did leafhoppers taken from healthy orchard trees, confined for 1–2 weeks on caged trees with yellows or little peach and transferred to healthy trees, transmit the disease. Experiments during 1934 and 1935 showed that heat treatment at 95°F. or over cured peach trees of either disease. This was interpreted as showing that the virus can be inactivated in peach tissues by exposure to such temperatures. It was thought that the failure of the transmission experiments might be explained by the inactivation of the virus in the vector by the high temperatures prevailing at the time. It has so far not been possible to test this theory by experiments on *M. trimaculata*, but experiments on the transmission of aster yellows by *Macrosteles* (*Cicadula*) *sexnotata*, Fall. [**25** 679] showed that this virus, which is similar to the viruses of peach yellows and little peach in its reaction to heat, could be inactivated by exposing the leafhoppers to a temperature of about 90°F., the duration of the inability to transmit the disease increasing with the duration of the exposure to the high temperature. It is therefore probable that the inefficiency of *Macropsis trimaculata* as a vector of peach yellows and little peach is due in part at least to the low thermal inactivation points of the viruses concerned.

Insects in Relation to Diseases of Shade and Forest Trees (pp. 23–24) by J. G. Leach is a commentary on a film based on investigations in Minnesota [**23** 1] on the association of two species of bark-beetles [*Ips pini*, Say, and *I. grandicollis*, Eichh.] with blue-stain fungi in Norway pine [*Pinus resinosa*].

In Insects in Relation to Diseases of Cereal and Forage Crops (pp. 24–38), F. W. Poos reviews the literature on this branch of the subject, dealing chiefly with diseases of rice, maize, sugar-cane, lucerne, ground-nuts and clovers in various parts of the world.

N. E. Stevens, in Problems involved in Control of Plant Diseases and Insects (pp. 39–44), advocates greater co-operation between pathologists and entomologists, more attention to the relation between the value of the crop and the cost of control, greater inter-state and international co-operation, research by experienced persons instead of students, the examination and trial of unconventional methods of control, fuller study of insects and fungi that are potentially harmful, and prevention instead of control where this can be effected by selection and breeding or by discouraging the planting of specific crops in areas where the hazard of disease or infestation by insect pests is great.

Craig (R.) & Clark (J. R.). **The Hydrogen Ion Concentration and Buffer Value of the Blood of Larvae of** *Pieris rapae* **(L.) and** *Heliothis obsoleta* **(F.)**.—*J. econ. Ent.* **31** no. 1 pp. 51–54, 3 figs., 13 refs. Menasha, Wis., February 1938.

Work on the hydrogen-ion concentration and buffer value of the body fluid of insects, a knowledge of which is of value in interpreting the physiological action of insecticides [*cf. R.A.E.*, A **23** 27], is reviewed from the literature, and a description is given of the apparatus and method used to obtain data on the buffering effect of the body fluids of larvae of *Pieris rapae*, L., and *Heliothis armigera*, Hb. (*obsoleta*, F.) in the last two instars. Individual variation was slight. Larvae of the last instar gave a more alkaline reaction and had a greater buffer value than those of the preceding instar. The pH values of fluid from larvae of *P. rapae* of the last and preceding instar ranged from 7·02 to 7·56 and from 6·76 to 7·0, respectively ; the values for *H. armigera* were 7·16–7·3 and 6·66–6·88. No definite buffer system was evident, but there was a general buffer effect between pH 4 and 7·5, probably due to the composite effect of several salts and proteins.

In *P. rapae*, the buffer value at a pH near 4·5–5·0 was about 0·01. Both species have a rather low buffer action towards any weak acid that may enter the body fluid.

SEIFERLE (E. J.), ADAMS (J. A.), NAGEL (C. M.) & HO (W. C.). **Effectiveness of Fluorine Compounds as Food Poisons for the Firebrat.**—*J. econ. Ent.* **31** no. 1 pp. 55–60, 2 figs., 17 refs. Menasha, Wis., February 1938.

Investigations were carried out to determine the relative effectiveness of various fluorine compounds in comparison with sodium fluoride [*cf. R.A.E.*, A **24** 539] as food poisons for *Thermobia domestica*, Pack. Each compound was mixed at 4, 8 and 12 per cent. concentrations with the standard food [*loc. cit.*]. The insects, which had been starved for 24 hours previously, had constant access to the baits, but were not obliged to remain in contact with them. They were kept at about 38·5°C. [101·3°F.] [*cf.* **26** 225] and 70–75 per cent. relative humidity. Mortality was negligible in controls, either starved or given unpoisoned food. The results are interpreted mathematically. The hours needed for the 4, 8 and 12 per cent. concentrations to give 50 per cent. mortality were 47, 30 and 28 for sodium fluoride, 51, 44 and 39 for sodium fluosilicate, 56, 58 and 58 for barium fluosilicate and 134, 108 and 90 for sodium fluoaluminate. Sodium fluoride was the only poison that showed appreciable toxicity within 24 hours of ingestion. All concentrations of all the compounds produced 100 per cent. mortality; sodium fluoride and both fluosilicates in about the same time, and sodium fluoaluminate in a rather longer time.

Experiments in which baits containing the compounds in 12 per cent. concentrations were exposed to the insects for 24 hours and then removed indicated that the slower production of mortality with the two fluosilicates was due to their slower lethal action and with sodium fluoaluminate either to its being repellent or to its lethal dosage being higher.

SMITH (R. H.). **Nicotine Vaporizing Equipment for Field and Orchard Use.**—*J. econ. Ent.* **31** no. 1 pp. 60–64, 2 figs., 10 refs. Menasha, Wis., February 1938.

An illustration and a description are given of an improved nicotine vaporiser [*cf. R.A.E.*, A **23** 179; **24** 169; **26** 21] designed and built in 1935 for use on field or orchard crops. The principal assemblage consists of a heavily constructed two-wheeled trailer on which is mounted a petrol engine, a small air compressor, two nicotine storage tanks provided with gauges, a tank of butane, a vaporising unit, a " vapour box " and a blower through which the vapour is drawn and discharged through a spreader upon the plants. The vaporising unit is described. When used for the control of Aphids on peas in California, the equipment treated a strip of peas 40 ft. wide and moved at the rate of 100 ft. in 1–1½ minutes. At 60–70°F., it was necessary to vaporise Black Leaf 50 (an aqueous preparation containing 50 per cent. nicotine alkaloid) at the rate of 5–8 oz. per minute to obtain a satisfactory kill of Aphids. Special devices were included to ensure complete vaporisation of the nicotine, to maintain a high concentration and to reduce loss from condensation, as the boiling point of nicotine is 476°F., and if the blower and spreader are not sufficiently heated, the vapour becomes greatly cooled. A dragsheet ensured the maintenance of a sufficiently high concentration of vapour during the exposure period of 1 or 2 minutes when the apparatus was being used on peas. The cost is relatively high, and the apparatus complicated, but this may probably be overcome by using a heated coil to vaporise the nicotine.

ELLISOR (L. O.) & FLOYD (E. H.). **Toxicity of several Stomach-poison Insecticides to four Species of Lepidopterous Larvae.**—*J. econ. Ent.* **31** no. 1 pp. 65–68, 1 ref. Menasha, Wis., February 1938.

During 1936 and 1937, the relative toxicity of barium fluosilicate, calcium arsenate, sodium fluoaluminate and acid lead arsenate was determined for fifth-instar larvae of certain Lepidoptera. The median lethal dose (M.L.D.) was used as the measure of toxicity. In some of the tests, it was determined by the single leaf method [*R.A.E.*, A **25** 245]; in the others, portions of leaf 1 cm. square were used and the dust particles made to adhere to them with a paste of equal parts by volume of a 0·5 per cent. blood albumen solution and a 5 per cent. dextrin solution. A device to facilitate the counting of the square millimetres of leaf consumed is described. The M.L.D.'s (in mg. per gm. body weight) of sodium fluoaluminate for *Pieris* (*Ascia*) *rapae*, L., *Plusia* (*Autographa*) *brassicae*, Riley, *Hyphantria cunea*, Drury, and *Anticarsia gemmatalis*, Hb., were 0·68, 0·42, 0·45 and 0·17, and of calcium arsenate 0·74, 0·50, 2 and 0·11. The M.L.D. of barium fluosilicate was determined only for *Pieris*, for which it was 0·43. The M.L.D. of lead arsenate for *Anticarsia* was 0·12, and for *Pieris* 0·09 without the paste and 0·10 with it.

CUPPLES (H. L.). **Wetting Properties of Triethanolamine Oleate.**—*J. econ. Ent.* **31** no. 1 pp. 68–70, 2 figs., 7 refs. Menasha, Wis., February 1938.

The following is the author's summary: At concentrations from 0·01 to 1·00 per cent. oleic acid, the wetting power of aqueous triethanolamine-oleic acid mixtures increases with increase of the ratio of triethanolamine to oleic acid, at least up to the mole ratio 6·0. At moderately high concentrations, such as 1·00 per cent. oleic acid, there is no abrupt change in wetting properties in the vicinity of the ratio 1·00 (point of equivalence), such as occurs when the base is a caustic alkali. Solutions of triethanolamine oleate readily produce a stable foam, and the material has a number of desirable properties which make it an efficient wetting agent.

MACKIE (D. B.). **Methyl Bromide—Its Expectancy as a Fumigant.**—*J. econ. Ent.* **31** no. 1 pp. 70–79, 7 refs. Menasha, Wis., February 1938.

The ways in which methyl bromide has been used for fumigation, with or without a partial vacuum, are outlined. Its insecticidal action appears to be toxic rather than narcotic, and it acts slowly; it can seldom be used with exposures of less than 90 minutes. Lists are given of fruits, vegetables, herbaceous plants, and palms that have been successfully treated either experimentally or under industrial conditions, with, in each case, the insect pest or pests concerned. No injury was incurred by dormant woody perennials treated with 2·5–3·5 lb. per 1,000 cu. ft. according to temperature. Varying results were obtained in tests with orchids, some of a given genus tolerating 3 times the concentration that kills others. A dosage of 1 lb. per 1,000 cu. ft. of grain applied under gas-tight tents for 12 hours or more gives complete kill of all stages of *Calandra* (*Sitophilus*) *granaria*, L., *Sitotroga cerealella*, Ol., and species of *Tribolium*, *Oryzaephilus*, *Ephestia* and *Plodia*. In California, more methyl bromide is used in treating dried fruit than for any other purpose. The same dosages are used as for grain and are equally effective against *E. figulilella*, Gregson, and *P. interpunctella*, Hb.

Occasionally, specific resistance to methyl bromide is noticed in some insects or lack of tolerance of it in plants ; the latter is explained by its fat-solvent properties. Some Thysanoptera and the eggs of certain Coccids seem to possess inexplicable resistance. Larvae of the codling moth [*Cydia pomonella*, L.] in the centre of pears, and San José scale [*Aonidiella perniciosa*, Comst.] are particularly susceptible, succumbing to dosages of 8 and 4 oz. per 1,000 cu. ft., respectively, the latter for 16 hours. Preliminary tests on *Reticulitermes hesperus*, Banks, were made in the soil under a school, 300 × 75 ft. in area. In the course of 4 months, 10 cc. methyl bromide was injected into each of the 160 passages. In only three cases were new passage-ways built. No alate brood emerged with the autumn rains. Various exposures to methyl bromide, the details of which are shown in a table, did not impair the germinating powers of any seeds tested, *viz.*, barley, wheat, ground-nuts, carrots, beans, turnips or lettuce. Quotations are given from evidence of experience of the effect of methyl bromide on man, including an account of one fatality. Lack of distinctive odour at toxic doses makes it insidious.

FISK (F. W.) & SHEPARD (H. H.). **Laboratory Studies of Methyl Bromide as an Insect Fumigant.**—*J. econ. Ent.* **31** no. 1 pp. 79–84, 13 refs. Menasha, Wis., February 1938.

Methyl bromide compares favourably with hydrocyanic acid gas, chloropicrin and ethylene oxide in its toxicity to insects. The median lethal concentrations of this fumigant for *Tribolium confusum*, Duv., *Calandra* (*Sitophilus*) *granaria*, L., *C.* (*S.*) *oryzae*, L., and *Bruchus* (*Acanthoscelides*) *obtectus*, Say, at 77°F., for 5 hours were 10·2, 5·5, 4·0 and 6·1 mg. per litre and for eggs of *T. confusum* 5·5–5·9. Incomplete data indicate that *Oryzaephilus surinamensis*, L., and a species of *Laemophloeus* are less resistant to it than is *C. granaria*. The degree to which different fumigants are absorbed by finely-ground whole wheat flour was determined by hanging test cages of insects above layers of flour 2 inches thick in the 6-litre fumigation flasks. The flour absorbed rather large quantities of all the fumigants, but the extent of absorption depended upon the properties of each, and the ratio of the median lethal concentration in the presence of flour to that in the absence of an absorbent was obviously related to the vapour pressure as indicated roughly by the boiling point. The two median lethal concentrations, the ratio between them, usually to the nearest whole number, and the boiling point of 11 common fumigants are given in a table. Tests were made in which 4 litres of flour were placed in a flask of 6 litres capacity, a cage of adults of *T. confusum* hung over the flour and another buried four inches in it, and the whole fumigated with methyl bromide at the rate of 32 mg. per litre (2 lb. per 1,000 cu. ft.) for the entire volume. Without flour, this would be three times the median lethal concentration. The average kill of the insects in the flour was 59·8 per cent. The influence of various reduced pressures upon the toxicity of methyl bromide to *T. confusum*, in empty flasks and in the presence of absorptive materials, was investigated. Very little methyl bromide was absorbed by raisins, slightly more by wheat. The presence of 0·9 litre of flour in a flask of 5·43 litres capacity approximately doubled the median lethal concentration throughout the pressure range. The experiments were carried out at 77°F., with an exposure of 90 minutes. This reduction in exposure increased the median lethal concentration at atmospheric pressure from less than 11 to 32·5 mg. per litre. The median lethal concentrations of methyl bromide for *T. confusum* and *C. granaria* at different temperatures without absorptive material are given in a table. The toxicity of methyl bromide appeared to be affected about as much by temperatures between 59° and 95°F. as that of carbon dioxide and considerably less than that of chloropicrin. Reduction of the relative humidity from 80–90 to 10–20 per cent. increased the median lethal concentration to adults of *T. confusum* from 8·5 to 10·5 mg. per litre. The effect of moisture on the toxicity to the eggs was so slight as to be of doubtful significance. Tests on the effect of fumigation at different concentrations for 5 hours on the germinating powers of maize, oats, barley, wheat, beans and peas indicated little chance of injury.

HAUG (G. W.) & PETERSON (A.). **The Effect of Insecticides on a beneficial Coccinellid,** *Hippodamia convergens* **Guer.**—*J. econ. Ent.* **31** no. 1 pp. 87–92, 3 figs., 2 refs. Menasha, Wis., February 1938.

The following is from the authors' summary and discussion of experiments on the toxicity of 14 common insecticides to eggs, larvae and adults of *Hippodamia convergens*, Guér. : The results presented were derived exclusively from indoor tests, but may be indicative of the effect on predacious Coccinellids of the use of the sprays under field conditions. Of the insecticides tested, thiodiphenylamine (phenothiazine) and derris were the most toxic to all stages of the Coccinellid. Thiodiphenylamine killed 95–100 per cent. of the adults, eggs and larvae, and derris killed approximately 70 per cent. of the adults, 46 per cent. of the larvae and 14 per cent. of the eggs. The egg-mortality reported with derris is much greater, if the large number of larvae that died a short time after they hatched are included. Nicotine sulphate and some of the arsenicals, particularly Paris green and calcium arsenate, proved to be fairly toxic to adults, especially if thirsty adults were used or if adults were confined in sprayed cages with sprayed Aphids. All other insecticides in the tests gave an average kill of less than 25 per cent. and in many cases there was no kill. In general, the insecticides appeared to kill more adults than eggs or larvae.

JAYNES (H. A.). **Introduction and Recovery in Florida and Louisiana of Parasites of the Sugarcane Borer.**—*J. econ. Ent.* **31** no. 1 pp. 93–95, 5 refs. Menasha, Wis., February 1938.

In this paper, a report is given of the collection of parasites of *Diatraea saccharalis*, F., in Peru in 1932, for introduction into Florida and Louisiana, and a summary of work in these states with them and the parasites previously received from Argentine and Peru [*R.A.E.*, A **20** 286, 287 ; **21** 505]. During 1932, 46,522 adults of *Ipobracon rimac*, Wolcott, of which 72·2 per cent. survived, were sent from Peru to Florida and most were forwarded to Louisiana. A few adults of *Microdus* (*Bassus*) *stigmaterus*, Cress., were included in the shipments. A total of 13,748 adults of *Theresia* (*Paratheresia*) *claripalpis*, Wulp, reared from puparia in Peru, were shipped and 29·3 per cent. survived. In one case, however, 94·3 per cent. survived. The Braconids were transported in a crate of a type already described [**20** 287], and the flies in somewhat larger crates covered with a padding of cotton-wool and with caramel tacked to the side as food. Of 392,296 puparia of *T. claripalpis* shipped, 13·9 per cent. gave rise to adults. More adults emerged from those reared from fly larvae collected in the field and sent by air than from those collected and sent by sea. In Peru, the puparia were not apparently affected by being kept for about 12 days at 55°F., but those transported in the ships were kept at a lower temperature for a longer period. Older puparia collected in the field were heavily parasitised. During a search for new parasites in a mountainous area of southern Peru, only 8 females of an undescribed species of *Ipobracon* were found, and these did not attempt to parasitise larvae of *D. saccharalis* with which they were confined. A few empty *Ipobracon* cocoons were found within sugar-cane stalks, but none containing a parasite. In Louisiana, 157,852 adults of *T. claripalpis* from Argentina and Peru were released on 21 plantations and 36,735 of *I. rimac* from Peru on 4 plantations in 1929–32, and 86 of *I. tucumanus*, Brèthes, from Argentina in 1929. In Florida, 4,048 adults of *T. claripalpis* and 12,939 of *I. rimac* were released, each on 2 plantations, in 1932. *I. tucumanus* has not been recovered. In 1931, 9 empty cocoons, which no doubt were those of *I. rimac*, were found in Louisiana in a cane field where adults had been released that year. In the autumn of 1932, several cocoons, some of which produced adults, were found in Louisiana in two places where releases had been made in the same year. The species was also recovered in Florida in a field where releases had been made in May. In Florida, at a place where *I. rimac* and *T. claripalpis* had been released in 1932, 8 empty cocoons and a fragment of an adult of a species of *Microdus* (*Bassus*) were found in 1934, and 5 empty cocoons, 2 cocoons containing parasites and 14 parasitised larvae of *D. saccharalis* from which adults of *M. stigmaterus* were reared, in 1935. This species reproduces parthenogenetically. The highest parasitisation ever found by the author in Peru was 9·7 per cent., but in one field in Florida 15·38 per cent. apparent parasitism was obtained. In an examination lasting a few hours in January 1936 in the same district, 3 empty cocoons and 13 live borers were found and one adult of *M. stigmaterus* was obtained from the latter. *T. claripalpis* has never been recovered in either state except for one puparium found in the autumn of 1932 in a plantation in Louisiana where releases had been made in that year. Six flies reared from puparia found in Florida in January 1936 do not appear to agree exactly with *T. claripalpis*, but it is not certain that a distinct species is represented.

Bigger (J. H.), Holbert (J. R.), Flint (W. P.) & Lang (A. L.). **Resistance of certain Corn Hybrids to Attack of Southern Corn Rootworm.**—*J. econ. Ent.* **31** no. 1 pp. 102–107, 5 figs., 2 refs. Menasha, Wis., February 1938.

The following is substantially the authors' summary: *Diabrotica duodecimpunctata*, F., is an important pest of maize in Illinois during certain seasons. Preliminary observations on the differential response of strains of maize to attack were made in 1927. During 1935, a more extensive study showed that hybrids in general were more resistant than local open-pollinated varieties. Some hybrids are more resistant than others. Factors in the resistance of strains of maize were shown to be their ability to recover after being damaged and also their resistance to root-rots that follow root pruning by the larvae. Maize growing on very fertile soil lodged more extensively than maize on poorer soil.

GAMBRELL (F. L.). **The Strawberry Root Weevil as a Pest of Conifers in Nursery Plantings.**—*J. econ. Ent.* **31** no. 1 pp. 107–113, 2 figs., 7 refs. Menasha, Wis., February 1938.

Otiorrhynchus (*Brachyrrhinus*) *ovatus*, L., causes considerable injury to conifers in nurseries in western New York [*cf. R.A.E.*, A **21** 463 ; **24** 278]. A list is given of species and varieties, known to be food-plants, of which the most seriously damaged were hemlock [*Tsuga*], Serbian spruce [*Picea omorika*] and six varieties of American arbor-vitae [*Thuja occidentalis*]. Hemlock is chiefly injured by the larvae attacking the roots, and arbor-vitae by the adults attacking the foliage. The latter injury is most evident during the summer or early autumn. Control measures should be applied during the pre-oviposition period. Tabulated data of the relative prevalence of larvae, pupae and adults on various dates in May and June in 1932 and 1936 and in mid-June in each of the years from 1932 to 1936 show considerable variation in the seasonal history. Field studies from 1931 to 1936 indicated that hibernation usually occurs in the larval stage, but occasionally in the prepupal or adult stages. Adults pass the winter under stones, débris, etc. The numbers that do so in western New York, are relatively small, but are sufficient to complicate control, necessitating additional treatment early in the spring.

Adults are always present in the field, but are most numerous and active from the middle or end of June until early August. In 1932, mortality began to increase in mid-August, and by early September about 90 per cent. of the weevils were dead. Overwintered adults have been observed to move about under trees and to feed by 15th May, before the overwintered larvae have pupated, but during favourable weather they may become active at a much earlier date. Newly-transformed adults begin to appear in the soil about the first week in June, but may not emerge for several days ; they emerge throughout June and sometimes in early July. The preoviposition period is difficult to determine under field conditions. In 1931, weevils that transformed on 13th June and were kept in confinement without food or water began ovipositing on 25th June. Overwintered weevils have been observed to lay eggs on 3rd June. Weevils that emerged from pupae during June 1932 deposited eggs as late as 25th August. Bait applied when about 75 per cent. of the adults have emerged greatly reduces infestation.

The larvae overwinter 6–14 ins. below the surface of the soil. Early in the spring, they begin to work upwards and pupate 1–2 ins. from the surface and near the centre of the root system. Pupae have been found from late May until 1st July. Differences of topography, soil and drainage produce considerable variation in the relative numbers of larvae, pupae and adults in places within a small area. On 9th June

1933, in one nursery, adults represented 0, 48 and 100 per cent. of the population in low and wet, medium, and high and well-drained soil, respectively.

Control measures tested by the author included soil fumigation with carbon bisulphide, paradichlorobenzene and naphthalene, the incorporation of lead arsenate and naphthalene into the soil to control the larvae, and the use of dusts, sprays and poison baits [*cf.* **26** 270] against the adults. None of the soil treatments gave appreciable control. The baits were used on both arbor-vitae and hemlock, and the most effective were 50 lb. raisins and 50 lb. shorts, and 100 lb. bran, 2 U.S. gals. molasses and 8 U.S. gals. water, both poisoned with 5 lb. sodium fluosilicate. Calcium arsenate and lead arsenate at the same rate in the bran-molasses bait gave very good control in some instances, but only fair in others. A spray of 6 lb. lead arsenate and ½ lb. calcium caseinate in 100 U.S. gals. water applied to hemlock on 2nd July 1931 showed an efficiency of only 22 per cent. on 14th July, and caused the needles to turn yellow and fall. A spray of 6 lb. calcium arsenate with a spreader gave high kill of the weevils on arbor-vitae and appeared to be promising. A bait of bran, molasses and calcium arsenate gave an efficiency of 93 per cent. four days after treatment, whereas a calcium arsenate spray showed 92 per cent. only 11 days after application. During wet weather, however, the kill from sprays is more rapid than that from bait.

BLANTON (F. S.). **Some Dipterous Insects reared from Narcissus Bulbs.**—*J. econ. Ent.* **31** no. 1 pp. 113–116, 15 figs., 6 refs. Menasha, Wis., February 1938.

Records are given of Diptera, mostly Ortalids, reared from narcissus bulbs in New York. All were from decayed bulbs except *Merodon equestris*, F., which has recently infested 1–5 per cent. of the bulbs, though it had not previously been considered of any importance in the east of the United States.

SHANDS (W. A.), ALLEN (N.) & GILMORE (J. U.). **A Survey of Insect Injury to Tobacco grown for Flue Curing.**—*J. econ. Ent.* **31** no. 1 pp. 116–117, 2 figs. Menasha, Wis., February 1938.

A survey of 385 fields distributed over the areas of South Carolina, North Carolina and Virginia in which tobacco is grown for flue curing was made during August and September 1935 to determine the distribution and degree of injury caused to the leaves by insects. Slightly more than half of the leaves had been harvested when the survey was made. All the leaves on 25 plants from each field were examined. The data obtained from six sections of the area and the averages for the area as a whole are given in a table. *Epitrix* spp. (principally *E. parvula*, F.), *Protoparce* spp. (principally *P. sexta*, Joh.), *Heliothis* spp., and grasshoppers had injured 94·04, 36·93, 9·68 and 2·76 per cent. of the leaves, respectively, and 2·15 per cent. were uninjured. A smaller amount of injury was caused by *Dicyphus minimus*, Uhler, *Oecanthus* spp. and *Phthorimaea operculella*, Zell. *Protoparce* is considered a serious pest of tobacco grown for flue curing.

Hoffmann (C. H.). **Notes on *Leperisinus aculeatus* (Say) and its Parasites (Coleoptera, Scolytidae).**—*J. econ. Ent.* **31** no. 1 pp. 118–119, 5 refs. Menasha, Wis., February 1938.

In January 1936, a felled ash tree containing numerous old galleries of the Scolytid, *Hylesinus* (*Leperisinus*) *aculeatus*, Say, was found in New Jersey. It had a diameter, breast high, of 7 ins. and had probably been cut in the preceding spring. Sampling revealed the presence of large numbers of larvae of *Coeloides scolytivorus*, Cress., overwintering in cocoons in the ends of the larval galleries. The percentage parasitism was then estimated at over 50. Sections were left out of doors for the winter and placed in rearing containers in an outdoor insectary in late spring. Between 15th May and 18th June, they yielded 1,123 adults of *C. scolytivorus*, 30 of an undescribed species of *Hypopteromalus*, 22 of the Sphegid, *Stigmus americanus*, Pack., 3 of *Spathius* ? *canadensis*, Ashm., and one of an undescribed species of *Eurytoma*. Only *C. scolytivorus* was proved to have been parasitic on the Scolytid, but it is probable that the other Hymenoptera, except the Sphegid, are parasites of one or other of these insects. The emergence holes of *C. scolytivorus* were rather thickly interspersed with those of *H. aculeatus*. In about 7½ sq. ft. of bark were found 311 brood burrows, from 10 to 98 mm. long, and 10,979 larval galleries. There were 2,411 exit holes of *H. aculeatus* and 1,139 parasite cocoons in its larval galleries. From this it may be calculated that parasitism amounted to about 32 per cent.

Salman (K. A.). **Recent Experiments with Penetrating Oil Sprays for the Control of Bark Beetles.**—*J. econ. Ent.* **31** no. 1 pp. 119–123, 1 ref. Menasha, Wis., February 1938.

Since 1931, field and laboratory tests have been carried out in California on the use of sprays of oil for the control of bark-beetles in pine. Preliminary tests of oils ranging from the heavy viscous grades to the light, volatile types showed that the light distillates caused the highest mortality. The best results were obtained with an oil of this type having crude flake naphthalene dissolved in it at the rate of ¾ lb. per U.S. gal. Trees were felled and limbed, and the oil was sprayed on to the bark until it began to run off. Average mortality of *Dendroctonus brevicomis*, Lec., on ponderosa pine [*Pinus ponderosa*] ranged from 18 to 80·4 per cent. in different experiments, and mortality in individual logs from 0 to 100 per cent. The effectiveness of treatment of broods of the Buprestid, *Melanophila californica*, Van Dyke, in *P. ponderosa* was variable, but fairly satisfactory. One test out of 11 gave complete kill. Results were unsatisfactory in November, a month after treatment, but by the following May, mortality was 81·6 per cent. These species are protected by thicker bark than *Ips confusus*, Lec., of which mortalities of 94 and 95 per cent. were obtained in the thin-barked tops. In lodgepole pine [*P. contorta*], 61–100 per cent. mortality of broods of *D. monticolae*, Hopk., was obtained in 1934 ; but in sugar pine [*P. lambertiana*] which may have bark 5 ins. thick, results were variable and in general unsatisfactory, as mortalities of only 44 and 46 per cent. were obtained in two field tests and many of the treated trees contained nearly normal broods. Results with *D. jeffreyi*, Hopk., in Jeffrey pine [*P. jeffreyi*] were similar to those with *D. monticolae* in sugar pine.

Variation in the resistance of individuals, brood stages and species, conditions of infestation, including the construction of ventilation holes, the layer in which development takes place and its moisture content, temperature, which must be above 50°F., coverage and the condition of the bark all influence the effectiveness of the treatment. In the field, 8–73 U.S. gals. were applied to 1,000 sq. ft. of bark, the average being about 20 U.S. gals. The heavier applications were more effective, but involved waste. Mortality is higher if the bark is removed from the trees and the inner surface sprayed. Spraying of uninfested portions of trees does not prevent subsequent infestation of the green phloem areas. In a laboratory test, mortality increased for 7–10 days, and in summer in the field, maximum mortality occurs 2–4 weeks after treatment. The difficulties of satisfactory transport and the cost, which is greater than that of removing the bark and burning it, prevent oil spraying from replacing the older method of control, but it might be of value where control is necessary in summer when the danger of fire is great.

KATSURA (S. K.). **Inoculation of young Cicada Nymphs with Spores of Green Muscardine Disease.**—*J. econ. Ent.* **31** no. 1 pp. 124–125, 1 fig., 3 refs. Menasha, Wis., February 1938.

In 1936, it was discovered that *Metarrhizium anisopliae* infests the mature nymphs of *Magicicada septendecim*, L., the adults being much less susceptible. Tests were therefore carried out on the infection of the newly-hatched nymphs. For this purpose, peach twigs bearing eggs were obtained from a part of Virginia where no fungous infection had been known ; the leaves were removed, the bark disinfected with a solution of mercury bichloride (1 : 1,000), and the twigs taken into a disinfected inoculation chamber, where they were suspended over Petri dishes placed to catch the nymphs as they hatched. These dishes contained either moistened soil mixed with 5 loops of spores of *M. anisopliae*, moistened soil without spores, sterile, moist filter paper upon which were dusted 3 loops of spores, similar paper without spores, or moistened soil in which was a dead mature nymph killed by a previous inoculation. Hatching began on 3rd October. All the nymphs in the spore-bearing dishes soon became contaminated, and all died in 15–24 hours except those in the dishes containing a mature nymph, which lived slightly longer. Those in the dishes without spores lived 4–15 days. White, cottony mycelium began to appear rather plentifully on the bodies of the nymphs 4–5 days after inoculation. The effect of the fungus was far more severe on the young nymphs than on the 17-year nymphs from which it was isolated.

DOZIER (H. L.). **A new Chrysanthemum Pest,** *Vanduzea segmentata* **(Fowler).**—*J. econ. Ent.* **31** no. 1 p. 125. Menasha, Wis., February 1938.

Vanduzea segmentata, Fowler, was described from Mexico in 1895 and subsequently recorded from Texas and Arizona, but its food-plants were not known. It appeared in Louisiana in August 1936 and has since spread and increased rapidly. It breeds on the egg-plant [*Solanum melongena*], but shows a preference for chrysanthemum, on which it was found breeding for the first time in large numbers in August 1937. A sulphated fatty alcohol (Orvus W. A. Paste), at the rate of

1 oz. per U.S. gal. water, gave excellent results against this Membracid and Aphids without scorching chrysanthemum when applied in late afternoon.

Reed (W. D.) & Livingstone (E. M.). **Postfumigation Effects on the Cigarette Beetle in Tobacco Bales.**—*J. econ. Ent.* **31** no. 1 pp. 125–126. Menasha, Wis., February 1938.

In fumigation experiments, test insects are usually removed after an exposure of 24–48 hours for fumigation at atmospheric pressure and 2½–4 hours for fumigation in partial vacuum, but this does not allow for the post-fumigation effects of absorbed or adsorbed gas. Experiments were carried out on the post-fumigation effects of hydrocyanic acid gas and a mixture of ethylene oxide and carbon dioxide on larvae of *Lasioderma serricorne*, F., in tobacco. Imported cigarette tobacco was fumigated with HCN at dosages of 4·3 and 5 lb. per 1,000 cu. ft. for 4 hours at an absolute pressure of 0·16–0·38 in., and cigar filler tobacco with the mixture at 58·7 lb. per 1,000 cu. ft., or 4·9 lb. per 1,000 lb. tobacco, for 4 hours at an absolute pressure of 0·86–1·00 in. The post-fumigation effects of HCN were greater than those of the mixture, but all showed that in order to judge accurately the effects of a fumigant, test lots of *L. serricorne* should not be removed from bales of tobacco until 72 hours after exposure.

Smith (F. F.). **Pest Problems on Chrysanthemums increased by the Practice of Shading.**—*J. econ. Ent.* **31** no. 1 pp. 126–127, 2 refs. Menasha, Wis., February 1938.

The practice, recently adopted in the United States, of covering chrysanthemums with black cloth from 5 or 6 p.m. to 7 or 8 a.m. to induce early flowering prevents air circulation and causes humidity and temperature to become very high and favour *Tarsonemus pallidus*, Banks, which was much more injurious on shaded than unshaded chrysanthemums in 1935 and 1936, both in greenhouses and in shelters out of doors. *Tetranychus telarius*, L., *Thrips nigropilosus*, Uzel, *Phenacoccus gossypii*, Tns. & Ckll., and *Phlyctaenia rubigalis*, Gn., were also more abundant on shaded than unshaded chrysanthemums in greenhouses, but this was probably because effective control measures were not applied during the period of shading. As sprays applied during the day often dry incompletely before the plants are covered and so favour leaf spot and loss of foliage, fumigants or dusts are preferable. If treatment at regular intervals is necessary, the plants should be left uncovered on the evening on which they are to be fumigated or on that following spraying. Repeated every 5 days, this procedure would delay flowering by about a week. To make up for this, shading should be begun earlier.

Jones (H. A.). **Effect of Insect Attack on the Rotenone Content of stored Cubé Root.**—*J. econ. Ent.* **31** no. 1 p. 127, 1 ref. Menasha, Wis., February 1938.

In 1931, specimen pieces of root were separated from a sample of cubé root consisting of 1,089 gm. root, tunnelled by *Dinoderus bifoveolatus*, Woll., and 27 gm. powder, presumably the result of its work. The remainder of the root was found to contain 3·3 per cent. rotenone.

Some years later, the root that had been kept, which the Bostrychid had continued to attack, was separated into 52 gm. root and 17 gm. powder, and these samples and the original samples of powder were analysed and found to contain 4·1, 2·3 and 1·4 per cent. rotenone, respectively. The net rotenone content of the whole specimen sample (the relative weights of the root and powder being taken into account) was about the same as that of the original sample of root. The rotenone content of another sample of powder from root infested with *D. bifoveolatus* was found to be 1·0 per cent. as compared with a reported content of 4·2 per cent. for the original root.

Jones (S. E.). **Life History and Control of** *Phthia picta* **Drury on Tomatoes.**—*J. econ. Ent.* **31** no. 1 pp. 127–128. Menasha, Wis., February 1938.

The Coreid, *Phthia picta*, Dru., has been a pest of summer-grown tomatos in southern Texas since 1933, and the main crop in the autumn may also be attacked. The adults and nymphs suck the fruits when these are ripe or almost ripe, causing yellowish spots to appear on the outside and producing dark green discolouration on the inside and unpleasant taste. The eggs are laid in rows on the tomato stems, usually on the upper half of the plant, in masses about 3·5 cm. long and containing about 25 eggs. The nymphs are gregarious during the first three instars, clustering on the fruit unless disturbed. During the first two instars, they are quiet and feed little. In the insectary in 1935, the average durations of the egg stage and the five nymphal instars were, respectively, 9·0, 4·7, 3·9, 4·0, 14·7 and 18·2 days. There are probably two and possibly three generations each summer. Adults have been observed feeding from early June to the end of October. In test cages, dusts of derris and sulphur (0·75 per cent. rotenone), derris and sulphur (0·50 per cent.), pyrethrum and sulphur (0·125 per cent. pyrethrins) and nicotine sulphate and lime (10 per cent. nicotine sulphate) gave, respectively, 97, 85, 5 and 5 per cent. kill of adults and nymphs. In 1935 and 1936, two applications of derris and sulphur (0·75 per cent. rotenone) at 25 lb. per acre effectively controlled *P. picta* on a field scale.

Knowlton (G. F.). **Horned Toads in Ant Control.**—*J. econ. Ent.* **31** no. 1 p. 128. Menasha, Wis., February 1938.

Details are given of the stomach contents of two species of lizards (horned toads) of the genus *Phrynosoma* taken in Utah. They consisted chiefly of ants. The vegetation on thousands of acres of range land in the western United States is destroyed by ants.

Nelson (R. H.). **Observations on Diptera breeding in Tomatoes.**—*J. econ. Ent.* **31** no. 1 pp. 128–129, 2 refs. Menasha, Wis., February 1938.

Studies were undertaken during 1934 on the types of tomatos infested with Dipterous maggots out of doors [*cf. R.A.E.*, A **25** 407] and the species of flies concerned. The tomatos were collected from the field or from canneries in Maryland and from the field in Virginia. No flies emerged from firm, ripe tomatos with unbroken skin or with suberised cracks or from overripe ones with unbroken skins. *Drosophila* *melanogaster*, Mg., emerged from firm fruit with fresh cracks ; *D. melanogaster*, *D. repleta*, Woll., and *Muscina stabulans*, Fall., from firm fruit with cracks in which mould was beginning to form ; these three species, *D. tripunctata*, Lw., and *Fannia canicularis*, L., from ripe fruit with numerous partly suberised growth cracks in some of which mould and decay had entered ; and most of these and several other Diptera from more decayed and discarded fruit. Eggs or young larvae of *D. melanogaster* cannot develop if the crack containing them suberises. Larvae of this Drosophilid were never observed to burrow through healthy skin. They feed near the surface. No other fly was reared from tomatos in which no mould or decay was present at the time of collection.

THOMPSON (B. G.). *Trichogramma evanescens* **Westwood, a Parasite of** *Melissopus latiferreanus* **Wlshm.**—*J. econ. Ent.* **31** no. 1 p. 129. Menasha, Wis., February 1938.

During studies of *Cydia* (*Mellissopus*) *latiferreana*, Wlsm., a serious pest of filberts [*Corylus*] in Oregon, it was observed that 14·2 per cent. of the eggs collected were attacked by a parasite, adults of which were determined as the species commonly known as *Trichogramma minutum*, Riley, but of which the correct name is considered to be *T. evanescens*, Westw. [*cf. R.A.E.*, A **23** 442].

WHITEHEAD (F. E.). **Scattering Grasshopper Bait from an Airplane.**—*J. econ. Ent.* **31** no. 1 p. 130. Menasha, Wis., February 1938.

In attempts made in Oklahoma to apply poisoned baits from aeroplanes, it was found that the hoppers constructed for dusting fields with calcium arsenate were quite unsatisfactory for scattering bran mash of the type usually employed, and when a man sat in the doorway of the aeroplane and scattered the bait from a sack, distribution was very uneven. Of a number of grasshopper baits recently tested, however, one of 100 lb. bran, 5 lb. white arsenic and 2 U.S. gals. cheap grade lubricating oil is of such a consistency that it can be effectively and evenly spread by an aeroplane ordinarily equipped for dusting cotton. With the aeroplane flying at a height of 20 ft. and 40 lb. bait in the hopper, there was an even flow for 550 yards. Scattering bait from an aeroplane is much more expensive than scattering by hand but is thought to be practical where time is an important factor.

Entomology.—*Bull. Ohio agric. Exp. Sta.* no. 579 (Rep. 1935–36) pp. 43–53. Wooster, Ohio, March 1937. [Recd. April 1938.]

C. R. Neiswander reports that larvae of *Ochrosidia villosa*, Burm., were very abundant in lawns in north-eastern Ohio in the autumn of 1936. No significant injury to the grass was observed after treatment with carbon bisulphide emulsions, 100 per cent. mortality being obtained when a stock emulsion of 10 parts carbon bisulphide, 1 part resin fish-oil soap and 3 parts water was applied at a dilution of 1 : 200 at the rate of 3 U.S. gals. per sq. yard. In field work on *Taeniothrips simplex*, Morrison (*gladioli*, Mlt. & Stnw.) on gladiolus during the past two years, a spray consisting of 2 lb. manganese arsenite, 30 lb. brown sugar and 50 U.S. gals. water gave excellent control, but caused severe foliage browning and reduction in corm yield. A reduction of the arsenical to 1 lb. resulted in effectiveness and injury equivalent to the Paris green formula previously tested [*R.A.E.*, A **25** 468]. It was found that the brown sugar in both formulae could be reduced by 10 lb. without loss of efficiency. *Corythucha cydoniae*, Fitch, severely infested *Cotoneaster* and quince (the only known food-plants in Ohio); in laboratory tests of insecticides against it, the most effective was a proprietary pyrethrum dust, which gave a mean mortality of 98·2 per cent. after 3 days.

R. B. Neiswander records that damage by *Cydia* (*Grapholitha*) *molesta*, Busck, on peach was greater in 1936 than in 1935; *Macrocentrus ancylivorus*, Rohw., continued to be its most effective parasite in northern Ohio [*cf.* **24** 746]. The latter had not hitherto been found in abundance in the more southern parts of the State, but in 1936 it destroyed 42 per cent. of the larvae in an orchard where it had been released in 1935. Its increase there is attributed to the occurrence on strawberry of an extensive population of *Ancylis comptana*, Froel., which it also attacks. The efficiency of various insecticides against the latter, measured by the number of injured strawberry leaflets in a 600-leaflet sample taken from each plot, with 5 plots for each insecticide, is shown in a table. Three applications of a dust containing 12½ lb. derris (4 per cent. rotenone) and 87½ lb. gypsum, and two of a spray containing a commercial preparation of cryolite, each gave 75–76 per cent. control. On the other hand, three applications of a cubé dust with the same carrier and rotenone content as the derris, though next in order of efficiency, gave only 47·2 per cent. control.

[J. S.] Houser and [J. B.] Polivka have found that standing pine trees weakened by road building work, which injures the roots or materially changes the water relationship in the soil, are rendered susceptible to bark-beetle attack. These trees should be removed in advance of infestation. No instance of the recovery of an infested tree has been observed.

[C. R.] Cutright reports that injury by *Saperda candida*, F., has increased since 1931 and that it is the most destructive insect attacking the bark and wood of apple near the soil surface. Various kinds of paper or burlap wrapped round the bases of the trees were all effective in preventing oviposition, and newspaper in two or three thicknesses was as effective as the others.

[H. L.] Gui describes the successful application of a dust consisting of 50 lb. spray lime, 50 lb. talc, and 5 lb. nicotine sulphate to control a serious outbreak of *Aphis gossypii*, Glov., in cucumbers grown for seed. He again found that much the most successful control of *Pieris* (*Ascia*) *rapae*, L., *Plusia* (*Autographa*) *brassicae*, Riley, and *Plutella maculipennis*, Curt., was obtained from the use of Paris green [*cf.* **25** 468], and tabulates the percentages of marketable heads of cabbage resulting from 12 different insecticidal treatments, a percentage of 92·9 being obtained after four applications of a spray containing 2 lb. Paris green, 1 U.S. pt. fish-oil and 50 U.S. gals. water, as compared with 30·1 on controls.

Under field conditions, [J. P.] Sleesman confirmed the results of laboratory studies showing a high correlation between soil moisture and the survival of the larvae of *Hylemyia antiqua*, Mg., on onion. Significant increases in larval populations may be expected in wet seasons. Sprays of Bordeaux mixture in which the ratio of lime to copper sulphate was varied all reduced the numbers of *Empoasca fabae*, Harr., on potato by an approximately equal amount, but the yield of tubers was significantly higher when the quantity of lime was reduced to half that of the copper sulphate. Significant differences were observed in the infestation by *Epitrix cucumeris*, Harr., of 24 varieties of potato, but the cause was not ascertained.

KEEN (F. P.). **Insect Enemies of Western Forests.**—*Misc. Publ. U.S. Dep. Agric.* no. 273, 209 pp., 92 figs., 86 refs. Washington, D.C., February 1938. Price 25 *cts.*

In the compilation of this field manual, which is intended for the use of foresters and timber-owners, all sources of information, including unpublished data from the files of the U.S. Bureau of Entomology, have been drawn upon to make the publication as comprehensive and up-to-date as possible. Although it is restricted to the insects of the forests of the western States, the general discussion and control methods are largely applicable to any part of the United States. The kinds of forest insects, the losses (both direct and indirect) that they cause, and their relation to forest management, are the subjects of an introductory section. Then follow chapters on insects affecting seed production, those injurious to seedlings in nursery or forest, insects injurious to young trees (saplings and poles), those injurious to mature forest trees, and insects injurious to wood and forest products, each including keys for their identification, so far as possible by the injury caused. A chapter on the pests of forest grazing plants is followed by one on the effects of climatic and environmental influences and natural enemies on the abundance of pests and one on silvicultural control, biological control, and direct artificial control. There is an index to trees as well as a general index.

PATCH (E. M.). **Without Benefit of Insects.**—*Bull. Brooklyn ent. Soc.* **33** no. 1 pp. 1–9, 13 refs. Lancaster, Pa, 13th April 1938.

In this address, the author discusses the wholesale destruction of insect life that results from modern methods of pest control, its effect on the production of crops that require insects for pollination, and the possibility that, at some time in the future, entomologists will be as much concerned with the protection of insects as they now are with their destruction.

BACK (E. A.). **Carpet Beetles.**—*Leafl. U.S. Dep. Agric.* no. 150, 6 pp., 10 figs. Washington, D.C., 1938.

Brief notes are given on the bionomics and control of carpet beetles, of which the species common in the United States are *Anthrenus scrophulariae*, L., *A. vorax*, Waterh., *A. verbasci*, L., and *Attagenus piceus*, Ol. Clothing stored in tight trunks, etc., may be cheaply protected by scattering 1 lb. flake naphthalene or paradichlorobenzene crystals between layers of thin paper placed at intervals in the layers of clothing. In tightly closed cupboards, either substance should be used at the rate of 1 lb. per 100 cu. ft. space. Persistent spraying of floors, cracks, skirtings, etc., with pyrethrum extract in oil and the frequent cleaning of rugs and carpets on both sides will ultimately eliminate these pests. Upholstered furniture containing hair is sometimes badly infested by

A. vorax, which is, however, of limited distribution [*cf. R.A.E.*, A **25** 291]. Fumigation is the best method of control, but treatment with a power sprayer that reaches the interior of the upholstering is sometimes effective.

CUTRIGHT (C. R.) **Codling Moth Biology and Control Investigations.** —*Bull. Ohio agric. Exp. Sta.* no. 583, 45 pp., 19 figs. Wooster, Ohio, July 1937. [Recd. April 1938].

A review is given of work since 1926 on the seasonal history and control of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in Ohio, preceded by a generalised account of its bionomics.

The following are the author's conclusions: The activities of the insect are greatly influenced by weather conditions. Temperatures below the mean during late May and throughout June aid greatly in its control during a given season. If temperatures are above normal during May and June, a serious outbreak is to be expected, as the eggs hatch in a shorter time and the larvae leave the apples earlier, resulting in a larger number of moths in the mid-summer broods. The increased risk of damage due to warm seasons may be offset by extra sprays applied after the calyx spray. Such sprays are designed to build up residues and poison early larvae. Bands applied before the first larvae leave the fruit are of value, because they also decrease the number of mid-summer moths and larvae. Moth emergence under natural conditions in the orchard extends over a longer period and is characterised by lower peaks than the emergence from cages. For commercial control in severe infestations, the minimum amount of spray considered adequate is $\frac{3}{4}$ U.S. gal. for each year of the tree's age per application. All surfaces of fruit and foliage must be covered by the spray.

From the standpoint of cost and efficiency, lead arsenate is still the best orchard insecticide. It should never be omitted in the calyx spray, but its use after the second cover spray will almost certainly produce excess spray residues. Other arsenates (calcium, zinc, etc.) are less effective, and their use in all-season schedules is not recommended. In orchards where insects are well controlled, they may be used in late-season sprays at $1\frac{1}{2}$ times the usual strength of lead arsenate, provided that excess lime is added. In their present forms they are not as safe as lead arsenate. Natural cryolite (the best of the fluorine sprays), when used with summer oil, is fairly effective against codling moth, but its use after the second cover spray also gives excess residues. Nicotine in its various forms, if applied frequently, is effective against codling moth, but not against apple maggot [*Rhagoletis pomonella*, Walsh]. It is more expensive than lead arsenate. Phenothiazine [thiodiphenylamine] has shown promise for codling moth control in the Pacific Northwest [*cf. R.A.E.*, A **25** 345], but experiments in Ohio [**25** 685] and elsewhere in the eastern States show that in its present form it is not suited to eastern conditions.

The use of the recognised practices in orchard sanitation is to be considered when a spray schedule of more than five cover sprays is necessary to control codling moth. Satisfactory control under conditions of heavy infestation is more nearly assured if, in addition to spraying, all supplementary sanitary practices are employed rather than only one or two.

ELLENWOOD (C. W.), MORRIS (V. H.) & SILVER (E. A.). **Removal of Spray Residues from Apples.**—*Bull. Ohio agric. Exp. Sta.* no. 584, 40 pp., 5 figs., 17 refs. Wooster, Ohio, July 1937. [Recd. April 1938.]

The following is taken from the authors' summary of work in Ohio in 1935 and 1936 : On apples from trees thoroughly sprayed with one or more applications of lead arsenate after 1st July, the amount of lead residue usually exceeded the tolerance (0·018 grain per lb.), and when lead arsenate was applied as late as mid-June and some substitute insecticide was used for later applications, the lead residue was near the tolerance. When the use of lead arsenate was confined to the petal-fall spray and one cover spray in the first week in June, the lead residue was well within the tolerance. Oil used to supplement lead arsenate in the first two cover sprays caused no appreciable increase in lead residue at harvest. Substitution of calcium arsenate for lead arsenate in the late summer sprays reduced the lead without a significant reduction in arsenic. Apples sprayed with lead arsenate throughout the season generally showed a little more than twice as many grains of lead as of arsenic residue at harvest time. Heavy rainfall in the late summer and early autumn of 1935 did not materially aid in meeting tolerances. Washing fruit once in the under-brush flood-type washer, using either 1 or 1·5 per cent. hydrochloric acid, almost invariably reduced lead residue well within the tolerance even on apples that had received 7 cover sprays. Heating the washing solution increased its efficiency. The flotation washer was less effective. Russeting of the skin of Jonathan apples resulted in a heavier deposit of residue and made washing more difficult. Sodium silicate used in the regular lead arsenate mid-summer spray [*cf. R.A.E.*, A **24** 64, 600] resulted in serious injury to apple foliage ; applied a week before harvest, it reduced the residue, but not enough to avoid the need for washing apples that had received a late July application of lead arsenate.

FENNAH (R. G.). *Citrus* **Pest Investigation. Oviposition and Parasitism of** *Diaprepes* **in St. Lucia in 1937, including Notes on the** *Citrus*-**growing Areas and on recent Experimental Work.**—32 pp., 8 figs., 17 refs. Trinidad, Imp. Coll. trop. Agric., November 1937. [Recd. April 1938.]

This is a report of preliminary observations in 1936 and a more detailed investigation in 1937 on the factors concerned in infestation of the roots of *Citrus* by larvae of *Diaprepes* in St. Lucia [*cf. R.A.E.*, A **25** 83], where *Diaprepes abbreviatus*, L., and *D. esuriens*, Gylh., both occur [*cf.* also **26** 405].

The following is based on the author's summary. Early records of these two weevils in various islands in the West Indies are reviewed. The types of *Citrus* cultivation in St. Lucia are described, and the estates are divided into four main ecological groups. The variation in infestation of different estates is discussed, and it is shown that a broad correlation exists between the intensity of oviposition and the abundance of *Gliricidia maculata*, which is a " complete host " of *Diaprepes* and is used as a shade tree in and near the plantations, that budded limes often show more damage than those grown from seedlings, and that flooding and irrigation do not seem to affect the weevils. The relation of oviposition to the larval population, and the effect upon it of meteorological factors are discussed. Some of the eggs of *Diaprepes* were destroyed by parasites, considered by A. B. Gahan to be undescribed species of *Tetrastichus* and *Ufens* [*cf. loc. cit.*], but the percentage parasitism by them was very low. Egg mortality, averaging 4·8 per cent. in 1937, is considered to be due chiefly to condensation of water round eggs and unfavourable position of eggs in the cluster.

In field trials, hand-picking of egg-masses and spraying trees with lead arsenate as a repellent proved ineffective. Experiments with paper strips to attract the ovipositing females [**22** 101] gave inconclusive results, and it would probably be impossible to use them on a large enough scale to give control. The hatching of the eggs and the behaviour of the newly hatched larvae when dropped on to different soil surfaces are described. When the larvae were on dry, exposed soil, sometimes almost half of them were seized by ants before they had burrowed. Field trials in St. Lucia directed against the newly hatched larvae are described. Paradichlorobenzene, calcium cyanide, and a commercial compound containing tar derivatives all proved useless as soil fumigants. Of a series of impervious and viscous layers, one (asphaltic oil on bagasse) shows promise. The use of lead arsenate on the surface of the soil showed some promise in a preliminary trial. A system of excavating soil from beneath the main roots close to the trunk and draining the basin so formed is now being adopted, as the larvae cannot attack the parts of the root and cortex below the collar that are not in contact with the soil, and it is injury to these parts that has the most serious results.

MURILLO (L. M.). **Sentido de una lucha biológica.** [An Example of biological Control.]—*Rev. Acad. Colomb. Cienc.* **1** no. 4 pp. 376–410, 3 figs., 13 pls., 23 refs. Bogota, 1937.

The author discusses the value of the biological control of insect pests and considers that investigations on it would be beneficial to agriculture in Colombia. Cotton in the republic is attacked by a pink bollworm, *Sacadodes pyralis*, Dyar ; the female reproductive organs of this Noctuid are described, and an account is given of its life-history and habits [*cf. R.A.E.*, A **14** 47 ; **15** 238]. In the Armero region, the egg, larval, pre-pupal, pupal and adult stages lasted 5, 13–15, 4, 20 and 2–9 days, respectively.

The application of insecticides for control would kill many beneficial insects, but nearly all the pupae of *S. pyralis* and many other pests would be destroyed by cultivation of the soil, which is considered to be the only artificial measure of value. A reduction in infestation could, however, probably be produced in Armero by planting quick-growing varieties of cotton fitting in with the periods of annual rains, which reach their peaks in May and November, and allowing an interval of 30 days between crops, which would be sufficient in view of the development cycle of *S. pyralis*. If necessary, the interval might be prolonged, but in any case it would be desirable to destroy wild cotton, and cotton in abandoned fields, on which breeding might continue.

The eggs, larvae and pupae of *Sacadodes* are attacked by various parasites, and the larvae are also destroyed by ants, such as *Ectatomma ruidum*, Roger, and by Vespids. Observations were made in experimental plots and insectaries on an unidentified Braconid that oviposits in larvae that are not more than four days old. As a rule, one egg is laid in each host. Parasitised larvae usually succeed in injuring only one of the carpels of a boll, whereas healthy larvae can destroy several bolls. The egg and larval stages of the Braconid lasted 7–10 days each, the prepupal stage up to 12 hours and the pupal 6–9 hours. Parthenogenesis occurs, the resulting progeny being males. From mid-May to mid-August, when the bolls are attacked by the larvae, *S. pyralis* produces two generations, while the Braconid can produce six. *S. pyralis* and the parasite may deposit up to 256 and 64 eggs, respectively. A Chalcidoid hyperparasite was obtained from up to 5 per cent. of the pupae of the Braconid.

Pickles (A.). **A Note on Pyrethrum as a possible Insecticide for the Control of the Sugar-cane Froghopper.**—*Trop. Agriculture* **15** no. 4 pp. 75–76. Trinidad, April 1938.

A brief account is given of a cage experiment and preliminary field experiments with pyrethrum dust and atomised sprays of pyrethrum extract in oils against adults of the sugar-cane froghopper [*Tomaspis saccharina*, Dist.] in Trinidad. In the field tests, the dust appeared to be rather more effective than the sprays ; it reduced the numbers of froghoppers on the plants by about 80 per cent. It does not adhere well to the leaves, but quickly slides down into the axils, which is probably an advantage as most of the froghoppers shelter in the axils during the heat of the day.

The results are considered sufficiently encouraging to justify trial on a much larger scale, and arrangements have been made for the purchase of materials and equipment suitable for the treatment of large areas during 1938.

Wallace (C. R.). **The Cineraria Leaf Miner** (*Phytomyza atricornis*) **damages Parks and Private Gardens.**—*Agric. Gaz. N.S.W.* **49** pt. 2 pp. 75–76, 79, 2 figs. Sydney, 1st February 1938.

Phytomyza atricornis, Mg., all stages of which are briefly described, causes extensive damage to the foliage of cinerarias in the Sydney district ; the egg, larval and pupal stages last 4–5, 7–8 and about 10 days, respectively [*cf. R.A.E.*, A **24** 512]. Alternative food-plants include a number of wild Compositae. Three spraying experiments are described, from which it is concluded that control can be obtained by spraying at intervals of 8–9 (or possibly 10–14) days with nicotine sulphate and soft soap, 1 : 2 : 400. Both surfaces of the leaves must be thoroughly wetted.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **49** pt. 2 pp. 98–102, 7 figs. Sydney, 1st February 1938.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **26** 334] includes notes on two weevils, *Axionicus insignis*, Pasc., and *Tepperia sterculiae*, Lea, that infest kurrajong (*Brachychiton*), the foliage of which is a valuable drought fodder. Adults of both species remain half-hidden in the cracks of the bark during the day. Those of *A. insignis* occur throughout the year and oviposit in damaged or dying branches. The larvae honeycomb the wood with circular tunnels, in which they pupate. Adults of *T. sterculiae* emerge in the spring. They deposit their eggs chiefly in the seed pods, and 4 or

5 larvae may develop in each one. Pupation takes place in the empty shell of the seed within the pod. Larvae also develop in large fleshy galls and abnormal growths on the twigs.

MARSHALL (Sir G. A. K.). **New injurious Curculionidae (Col.).**—*Bull. ent. Res.* **29** pt. 1 pp. 1–8, 3 figs. London, March 1938.

The new weevils described comprise: *Moropactus* (gen. n.) *lepidotus* and *M. perfidus* on leaves of cacao, *Anthonomus campinas* on flowers of cotton, and *Hemiliopsis spondias* on fruits of hog plum (*Spondias lutea*), all in Brazil; *H. aequalis*, which was collected in Panama and Colombia; *Diaprepes boxi*, of which the adults infest the foliage of *Citrus* and the larvae the roots of *Citrus*, *Urena lobata* and *Psidium guayava* in St. Lucia; and *Systates nocivus* on leaves of coffee in Nyasaland.

TAMS (W. H. T.). **Three new Moths (Agrotidae, Pyralidae) of economic Importance.**—*Bull. ent. Res.* **29** pt. 1 pp. 9–10, 1 fig., 1 pl. London, March 1938.

Descriptions are given of the Pyralid, *Noorda moringae*, sp. n., bred from larvae on buds of *Moringa* in South India [*cf. R.A.E.*, A **26** 55], and the Noctuids, *Sesamia pecki*, sp. n., from larvae attacking heads of jowari [*Sorghum*] in British Somaliland, and *Symitha mangifera*, sp. n., from larvae on young mango leaves in the Seychelles.

KLEIN (H. Z.). **On the Ecology of the Citrus Red Spiders in Palestine.**—*Bull. ent. Res.* **29** pt. 1 pp. 37–40, 1 fig. London, March 1938.

The following is substantially the author's summary: On the basis of ecological data, breeding experiments, and activity trials [*cf. R.A.E.*, A **25** 749–752], the two species of red spiders, *Anychus orientalis*, Zacher, and *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.) found in Palestine are differentiated. The reason for the different distribution of the two species throughout the world is given. *T. telarius* is found to be cosmopolitan, and *A. orientalis* subtropical.

CRAUFURD-BENSON (H. J.). **An improved Method for testing liquid Contact Insecticides in the Laboratory.**—*Bull. ent. Res.* **29** pt. 1 pp. 41–56, 7 figs., 1 pl., 15 refs. London, March 1938.

The following is the author's summary: Methods for laboratory testing of contact insecticides are reviewed, and some of the disadvantages of these methods are discussed. Reasons are given for preferring an immersion to a spraying method, and the necessity for a supply of "standardised" insects is stressed. An improved immersion method for laboratory testing of contact insecticides is described, and the rigid technique necessary is detailed. The effect on the resistance of *Ahasverus advena*, Waltl, to a derris insecticide of varying the time of immersion, the age of the insects, the temperature and the humidity before, during, and after immersion is illustrated and shows the necessity of controlling all these factors.

Results with a standard derris insecticide are given to show the great accuracy that can be obtained by the new method ; that the same result with the same insecticide can be repeated from day to day ; and that two workers using the same insecticide have obtained identical results. The reaction to starvation is correlated with variations in age, temperature and humidity, to show that the starvation death rate is a measure of the insects' powers of resistance to an insecticide. Statistical analysis and discussion of methods of expressing mortality is reserved for a later communication.

GRÜNBERG (A.). **The Mediterranean Fruit-fly** (*Ceratitis capitata*, **Wied.**) **in the Jordan Valley.**—*Bull. ent. Res.* **29** pt. 1 pp. 63–76, 3 figs., 4 refs. London, March 1938.

Of recent years, *Ceratitis capitata*, Wied., has sometimes caused severe damage in the southern belt of *Citrus* plantations in the Upper Jordan Valley. This account of its bionomics is based mainly on field observations made in plantations to the south of Lake Tiberias and some 660 ft. below sea level. Owing to the climatic conditions [*cf. R.A.E.*, A **25** 257], there is a substantial difference between its seasonal activity there and in other parts of Palestine. It appears that moderate temperatures in summer and winter and a low winter rainfall create optimum conditions for infestation. Severe outbreaks in the Jordan Valley have so far always been due to favourable conditions of a temporary character, the excessive heat being of particular importance as a levelling and reducing factor. In 1935–36 at least 10 per cent. of the total *Citrus* crop was lost, but in 1936–37 damage was negligible.

All varieties of *Citrus* are infested, but injury to lemons is rare and of no economic importance. The fruits most attractive to ovipositing females are not those most suitable for larval development. Thus, although orange appears to be preferred to grapefruit, more larvae survive in the latter, chiefly because the rag of the orange is more compact and less easily penetrated. Other important host-fruits are grapes and figs. It is unlikely that grapes will ever be seriously infested in the Jordan Valley, as they mature when the *Ceratitis* population is low. From June to August, however, they are an important alternative host-fruit for intermediate generations of the fly, and afford a means for spreading it throughout the country from the plains to the hills, where climatic conditions may be favourable for it at that time of the year. Figs susceptible to attack are on the trees from April to July and may be severely damaged by *Ceratitis* and *Lonchaea aristella*, Beck., especially in the hill country. *Ceratitis* adults are able to fly for only a short distance, but strong winds may be a factor in dispersal. Larvae are distributed in infested fruit, and this is the most important means of spread.

A few days after pairing, the females begin to deposit their eggs in the rind, in a small cavity drilled out by the ovipositor, several flies using the same cavity. Each fly deposits altogether 200–500 eggs. There may be as many as 40 punctures in a single fruit ; most of those attacked turn yellow prematurely, decay and drop. *Penicillium* may develop inside the punctures, so that the fruit decays even when the eggs or larvae perish in the early stages of development, and at the beginning of the season the greater part of the damage is due to this. Larval mortality is very high in *Citrus* fruits, especially during the winter, but towards the end of the season it is considerably lower, partly because of the improved weather conditions and partly because the rag becomes softer and thinner as the fruit matures. Varieties in which the rag is almost absent, such as mandarins, are the most favourable for larval development. The thickness of the peel is of less importance ; only when it is more than 10 mm. thick is larval mortality complete. There are 3 instars. Pupation takes place a little below the soil surface. Tables are given showing the ratio of the sexes, and the numbers of gravid and spent or virgin females monthly from November 1935 to June 1937.

At average temperatures of 13·5 and 24·3°C. [56·3 and 75·74°F.], the winter and summer generations lasted 100 days (from mid-November to 25th February) and 30 days, respectively ; the threshold of development was calculated to be 9°C. [48·2°F.]. In the Jordan Valley, there is an intermediate generation, the adults of which appear between November and January, that does not occur on the coastal plains or on the hills. At 12–14°C. [53·6–57·2°F.], the flies remain inactive, so that only in exceptionally mild winters would this generation become economically important. It may, however, possibly be dangerous in accelerating infestation in the spring. The flies of the first after-winter generation (the offspring of the intermediate one) usually appear at the end of February and in March. Although they are generally not numerous, they may oviposit actively on *Citrus* fruits, which are still abundant, and the maturity of the fruit, together with favourable weather conditions, promotes larval development. The second-generation flies are active in April and May and may oviposit in 70–80 per cent. of the fruit still on the trees, although the scarcity of oranges may drive some of them out of the groves to other hosts in the vicinity. The adults of the third generation appear towards the end of June, but in July there is a sudden drop in the population, owing to the increasing heat. The fourth and fifth generations, and part of the sixth, develop outside the *Citrus* groves. There are one or two generations (the sixth and seventh) in the *Citrus* groves before the beginning of the heavy rains lasting from the end of September until November, and finally the intermediate one. Under particularly favourable conditions, a ninth may possibly occur. The adults of the first two generations are the most important, and *Citrus* is most heavily infested in April and May or in May and June ; infestation, although less serious, is again important in October and November.

The timing of control measures is discussed. In general they should be applied in October, November and March, but the periods are subject to alteration according to fluctuations in the fruit-fly population, which should be determined by bait traps, 10–15 being placed in each grove. When, as at extremes of temperature, the population was low, 25 per cent. vine vinegar was the most sensitive indicator, but when it was high, 5 per cent. Clensel, which is easier to work with, caught as many flies. Extensive experiments in progress on the control of the adults by means of bait-sprays and traps are not yet complete, but it has been ascertained that spraying is much cheaper, and that from the biological point of view there can be no objection to it as peak infestation occurs at very suitable seasons. Infested fruits may be distinguished by their premature yellow colouring and should be picked at the beginning of the season. No fruit should be left on the trees after completion of the picking season.

CHERIAN (M. C.) & ISRAEL (P.). *Stenobracon nicevillei*, **Bingh. (Hym. Brac.), a natural Enemy of the Sugar-cane White Moth Borer** (*Scirpophaga*).—*Bull. ent. Res.* **29** pt. 1 pp. 99–102, 9 figs., 2 refs. London, March 1938.

Sugar-cane in Madras is subject to the attack of a number of insect pests, of which the moth borers, *Diatraea sticticraspis*, Hmps., *D. venosata*, Wlk., *Scirpophaga nivella*, F. (*auriflua*, Zell.), and *S. rhodoproctalis*, Hmps., are the most injurious. During the authors' investigations 7 parasites of the larvae of *Scirpophaga* have been reared, including *Glyptomorpha* (*Stenobracon*) *nicevillei*, Bingh., which is the subject of this paper.

The larva of *Scirpophaga* destroys the growing point of the cane by tunnelling downwards. Before pupation, it makes a short tunnel at right angles to the first, leaving it closed with a thin film of the outermost leaf-sheath. It spins partitions of silk as it withdraws into the tunnel. The life-cycle is completed in 2–2½ months. The female parasite pierces the wall of the horizontal tunnel with its ovipositor and paralyses the larva, depositing an egg on or near it. Pupae or exposed larvae are not attacked, and many larvae are too far from the exterior to be accessible. Two or three eggs were sometimes deposited on a single larva when the hosts were scarce, but only one adult emerged. The parasite larvae are ectophagous. They died when transferred to larvae that were unparalysed or that had been killed, but thrived on those paralysed by *G.* (*S.*) *deesae*, Cam. The life-cycles of 16 males and 2 females were completed in 14–21 and 21 days, respectively, and adult males and females lived 11–29 and 16–21 days. In 6–9 days 3 fertilised females laid 10, 10 and 12 eggs, and in 15 days a virgin female deposited 16. Only males were produced by unmated females. Under laboratory conditions, the parasite readily attacked other Pyralid borers of *Sorghum* and sugar-cane (*Chilo*, *Sesamia*, *Diatraea sticticraspis*, and *D. venosata*) ; it was rather common in fields of sugar-cane and *Sorghum* from March to August, although it has not been bred from *Sorghum* collected in the field.

As regards the economic value of the parasite, the authors point out that it lays few eggs and can only attack host larvae just before they pupate ; on the other hand it completes about three generations to one of the host, is easily reared under laboratory conditions, and is not apparently attacked by hyperparasites.

Agriculture and Animal Husbandry in India 1935–36.—411 pp., 2 pls., 1 fldg. map. Delhi, 1937.

Much of the information on insect pests (pp. 192–213) in this review of work in India in 1935–36 has already been noticed. In the Madras Presidency, the most important pests of sugar-cane were the top-borers, *Scirpophaga nivella*, F. (*auriflua*, Zell.), and *S. monostigma*, Zell., and the stem-borers, *Diatraea sticticraspis*, Hmps., and *D. venosata*, Wlk.

In the United Provinces, 47,100 acres were sown with cotton seed treated for the control of *Platyedra gossypiella*, Saund., by exposure to the sun. Damage in uncontrolled areas was below normal, but the improvement in yield and quality of cotton in the treated areas was very significant. Of the three species of *Earias* found on cotton in the Punjab, *E. insulana*, Boisd., *E. fabia*, Stoll., and *E. cupreoviridis*, Wlk., only the first two are pests, the first being the commonest. *E. insulana* and *E. fabia* are active throughout the year, but *E. cupreoviridis* hibernates as a pupa from October to April. *Bemisia gossypiperda*, Misra & Lamba, is most abundant on cotton from May to September, after which it migrates to potato, tomato, cruciferous vegetables and various weeds, on which it passes the winter. From March to May it spreads to cucurbits and ratoon cotton and then to new cotton. In the Central Provinces and Berar, damage to cotton by *Heliothis armigera*, Hb. (*obsoleta*, *F.*), hitherto unknown as a cotton pest in India, was as serious as that caused by *Earias*. It first bores the young shoots and later damages buds and young bolls. About 15 per cent. of the cotton crop in Hyderabad is lost annually through boll-worms. In the Madras Presidency, it was found that the incidence of *Pempheres affinis*, Fst., varied in inverse proportion to the length of the close period between the cotton crops. Cotton grown under drier conditions suffered less than that receiving irrigation or intermittent rainfall. A Braconid and three Chalcids were found parasitising the larvae, but together accounted for only 5 per cent. of the mortality. *P. affinis* was again found on cotton in Burma [**23** 504].

In the Madras Presidency, *Othreis* (*Ophideres*) *materna*, L., and *O.* (*O.*) *fullonia*, Cl. (*fullonica*, L.) [*cf.* **21** 502] were very injurious to tomato fruits, the former predominating. The moths were controlled by stupefying them with a bright light and then hand-picking them. *Plutella maculipennis*, Curt., caused severe damage to cabbage, but was effectively controlled by derris dust. In the United Provinces, the average attack by the apple root-borer, *Dorysthenes* (*Lophosternus*) *huegeli*, Redt., was over 6 per cent., rising to 20 per cent. in serious cases. The woolly aphis [*Eriosoma lanigerum*, Hsm.] damaged 22 per cent. of the apple trees. The shoot form was controlled by spraying, but the root colonies remained as a source of infestation. Carbon bisulphide and paradichlorobenzene proved very effective as fumigants against *Calandra oryzae*, L., in Assam, and exposures of 30–36 hours had no ill effect on the germinating powers of the grain.

KRISHNAMURTI (B.). **A microscopical Study of the Development of *Trichogramma minutum* Riley (the Egg-parasite of the Sugarcane Borers in Mysore) and its Parasitisation of the Eggs of *Corcyra cephalonica* Staint. (the Flour-moth employed in the Mass Production of *Trichogramma*).**—*Proc. Indian Acad. Sci.* (B) **7** no. 1 pp. 36–40, 5 pls., 4 refs. Bangalore, 1938.

Illustrations are given of various stages of development of *Trichogramma minutum*, Riley, reared in eggs of *Corcyra cephalonica*, Stn., in Mysore [*cf.* *R.A.E.*, A **25** 479], and factors affecting parasitism by it are discussed. When host eggs 24, 48, 72 and 96 hours old were exposed for about 96 hours to equal numbers of parasites, the percentage of parasitism was 90, 87, 82 and 29, respectively. It is not known whether superparasitism occurs [*cf.* **25** 50] ; host eggs usually contain 1 or 2 parasite eggs, but a maximum number of 9 has been found. In any case only 1 or sometimes 2 adults emerge. The ratio of parasites to host eggs in artificial rearing should, therefore, not exceed the minimum required for obtaining the maximum number of adults in the next generation.

de Peyerimhoff (P.). **Diffusion spontanée, dans l'Afrique du Nord du** *Rhizobius lophantae* **Blaisd. (Col. Coccinellidae).**—*Bull. Soc. Hist. nat. Afr. N.* **28** no. 8–9 pp. 481–482, 6 refs. Algiers, 1937.

Records are given of the finding in 1935–37 of isolated individuals of *Lindorus* (*Rhizobius*) *lophanthae*, Blaisd., in various places in Algeria and Tunisia. This Australian Coccinellid, the synonymy of which is briefly discussed, was taken to the United States in 1889. It was introduced into Italy for the control of Coccids in 1908 and is now established [*cf. R.A.E.*, A **19** 705]. It was recorded in Cyrenaica in 1930, having presumably been brought there on imported plants, and the fact that it has become widely distributed in North Africa suggests that the conditions are not unfavourable to it. The author considers that if it were now imported in large numbers it might prove of value in the control of several species of Coccids.

Roubaud (E.). **Recherches expérimentales sur le criquet pèlerin. IV.—Influence réactivante de la vie hivernale sur le métabolisme des ailés.**—*Bull. Soc. Hist. nat. Afr. N.* **28** no. 8–9 pp. 483–487, 1 graph, 1 ref. Algiers, 1937.

Four successive generations of *Schistocerca gregaria*, Forsk., ph. *transiens* developed at a uniform rate when kept continuously in humid and hot conditions, but in the fifth generation a considerable retardation was observed. No pairing or oviposition occurred in the course of nearly five months after the hatching of the hoppers, and the locusts that were still kept under the same conditions mostly died infertile. Those, however, that were then submitted to artificial hibernation (dry air and low night temperatures down to freezing point) matured rapidly and lived for seven months.

Volkonsky (M.). **Possibilité de changement de phase à l'état imaginal chez le criquet pèlerin** (*Schistocerca gregaria* **Forsk.**).—*C. R. Soc. Biol.* **127** no. 7 pp. 583–585, 4 refs. Paris, 1938.

Of immature adults of *Schistocerca gregaria*, Forsk., ph. *solitaria* collected in November 1937 in the Grand Erg of Central Sahara, 15 were placed in a wire cage exposed to the sun and fed on turnip leaves. They soon matured and laid eggs, and during the process of maturation acquired a yellow colouration characteristic of ph. *gregaria*. About 70 per cent. of the resulting hoppers had the black colouration of ph. *gregaria*, and the adults of this generation had the measurements of the ph. *transiens*. Isolated pairs retained the colouration of ph. *solitaria* and produced progeny of this phase. Thus, it appears that crowding of solitary adults may result in the appearance of gregarious characters in them and in the next generation.

A Poison Bait for young Locust Hoppers.—*Rhod. agric. J.* **35** no. 2 pp. 134–138. Salisbury, S. Rhodesia, February 1938.

Baits consisting of 2 lb. sodium arsenite and 98 lb. maize meal or 3 lb. sodium arsenite and 97 lb. maize bran with 8–10 gals. water are recommended for the control of hoppers of the red locust [*Nomadacris septemfasciata*, Serv.] in Southern Rhodesia. The water should not be added until the bait is required. In vegetation up to 1 ft. high, 60 lb. maize meal bait (dry weight) per acre is sufficient, but in tall, dense vegetation, 120 lb. may be required. Care should be taken that the bait falls evenly and free from lumps. It should be spread in the late afternoon, at night, or early in the morning, when the hoppers are least active. Dew is an advantage as it keeps the bait moist, but heavy rain completely destroys its efficacy, and during cold weather the hoppers do not feed. Hoppers in the first, second and third instars are more readily killed than older ones ; hoppers do not feed for 24 hours after hatching but they feed readily immediately after moulting. Most poisoned hoppers die about two yards from the feeding place. Usually 25–50 per cent. are dead or dying after 24 hours and 90 per cent. after 48 hours.

van den Merwe (C. P.). **Insects attacking Sugar-cane.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 171, 8 pp., 7 refs. Pretoria, 1937. Price 3*d.* [Recd. April 1938.]

Brief notes are given on insects attacking sugar-cane in Natal. *Trionymus* (*Pseudococcus*) *sacchari*, Ckll., is the most common, but as the injury caused by it seems to be slight, control measures are not applied. In an experiment in which infested canes were buried an inch deep in sandy soil in tins, kept watered and away from ants, all the mealybugs died before shoots appeared above ground, whereas they survived in similar soil in the open, where ants were present. The chief ant fostering this mealybug is *Pheidole megacephala*, F., but in cane fields the honey-dew is not all removed and may cause discoloration on the canes. *Aphis sacchari*, Zehnt., is very abundant at times, but is usually controlled by natural enemies and unfavourable climatic conditions before it has caused serious damage. *A. maidis*, Fitch, rarely occurs on cane, but is important as it transmits the virus of mosaic disease [*cf.* *R.A.E.*, A **24** 286]. *Perkinsiella saccharicida*, Kirk., has been found by the author in Natal ; it is comparatively rare, though it is not known what factors keep it in check. Many other Jassids and Fulguroids have also been observed on cane, but do not appear to be of any importance as pests.

The Dynastids, *Heteronychus licas*, Klug, and *H. tristis*, Boh., attack newly planted cane and also maize ; a Carabid of the genus *Scarites* has been observed destroying the adults of the former. *Laphygma exempta*, Wlk., sometimes causes considerable damage by destroying the leaves, and the use of poison bait and barriers to prevent the larvae migrating is recommended. *Cirphis leucosticha*, Hmps., is found in cane where it has been cut and trashed, and the larvae feed on the young shoots, but they are heavily parasitised by Tachinids and outbreaks are controlled in one generation. Two stalk-borers, *Sesamia calamistis*, Hmps., and *Busseola fusca*, Fuller, occasionally infest sugar-cane, but damage is not serious, probably because the variety most commonly grown becomes too hard when mature.

Other pests include grasshoppers, of which only *Nomadacris septemfasciata*, Serv., causes serious injury [*cf.* **24** 394], and termites.

Caserio (E.). **Osservazioni e ricerche sulla possibilità di applicazione pratica del piretro come antiparassitario in agricoltura.** [Observations and Investigations on the Possibility of the practical Use of Pyrethrum as an Insecticide in Agriculture.]—*Ann. Chim. appl.* **27** pp. 407–413. Rome, 1937. [Recd. April 1938.]

These investigations were made with a view to the substitution of Italian-grown pyrethrum for imported insecticides in Italy. The percentages of extract obtained by the Soxhlet method from good quality flowers of *Chrysanthemum* (*Pyrethrum*) *cinerariaefolium* were 32·4 in methylated spirits, 29·1 in ethyl alcohol, 5·6 in benzene, 6·15 in carbon tetrachloride, 4·5 in carbon bisulphide and 3·8 in petroleum ether. As each solvent extracts the same amount of the toxic principles, the purest extract was obtained with petroleum ether, but owing to the inflammability of the latter, carbon tetrachloride was used in the further tests. Thermo-centrifugal extraction gave a higher yield of extract than other methods tested and caused no modification in the insecticidal principles. The extracts thus obtained proved highly toxic in sprays against various insects. For emulsifying the extract, a soap mixture containing 8 parts mineral oil, 2 parts colophony, 1 part sodium sulphoricinate and enough sodium hydroxide to saponify the oil was found superior to a resinous soft soap, being more adhesive and retaining its qualities even when diluted with hard water. The pyrethrum extract was added to a solution of the soap and the resultant emulsion was further diluted for use. Tests confirmed the finding that alkalis in aqueous solutions and weakly alkaline soap do not, if cold, affect perceptibly the active principles of pyrethrum [*R.A.E.*, A **10** 574]. The sodium sulphoricinate enables the oleoresin to be emulsified to any desired degree and thus permits the dilution of extracts as required.

FEYTAUD (J.). **A propos de l'emploi des engrais chimiques pour la lutte contre le doryphore.**—*Rev. Zool. agric.* **36** no. 11 pp. 161–176, 4 refs. Bordeaux, November 1937. [Recd. April 1938.]

In a paper published in 1937, J. Jeannenot, Director of the Municipal School at Autun, claimed to have completely controlled *Leptinotarsa decemlineata*, Say, on potato by using a mixture of fish manure with certain chemical fertilisers instead of farm manure. He stated that the mature larvae were killed on entering the soil for pupation and that the females did not oviposit on the treated plots. In exhaustive field experiments here described the same mixture was applied, but there was no reduction in infestation. In laboratory experiments, in which larvae about to pupate were placed on soil treated with the mixture and with its separate ingredients, the numbers of adults emerging were not affected. Emergence was somewhat reduced in a similar experiment with cyanamide, but its effect was not great enough for it to be of value in control.

LEPESME (P.). *Hofmannophila pseudospretella* **Stt. (Lep. Gelechiidae), hôte indésirable des habitations et des magasins.**—*Bull. Soc. ent. Fr.* **42** no. 19 pp. 283–288, 4 figs., 1 pl., 9 refs. Paris, 1938.

During the winter of 1936–37, larvae of *Borkhausenia* (*Hofmannophila*) *pseudospretella*, Stn., were found attacking a stock of dried mint in the dark and unheated basement of a herbalist's shop near Paris. The mint was reduced to dust in a few months, only the stalks and a few fragments of leaves and piles of excrement remaining in the spring, but other dried plants stored near it were untouched. The adult moths emerged in June. The adult, egg and larva of this Tineid are briefly described, and its distribution and taxonomy are discussed. The author considers that *Hofmannophila*, of which it is the type, is generically distinct from *Borkhausenia* and compares their characters in a table. The habits of the larva, which is found in dark, damp, unheated places, are reviewed, chiefly from the literature. It is polyphagous [*cf. R.A.E.*, A **20** 256], but the author considers it a carnivorous insect that is able to adapt itself to dried animal matter and has gradually become accustomed to materials of vegetable origin. It is occasionally found in the starchy products of cereals or débris from them and frequently in the dust between the floor-boards of granaries and warehouses, where it finds a certain amount of organic material. It has never caused serious loss of stored grain, but it mines the corks of wine bottles when they are impregnated with liquid, and also attacks books [**20** 118, 255]. It infests wool, but is not known to attack silk or cotton. There is one generation a year. Oviposition lasts throughout the summer and the winter is passed in the larval stage.

GRASSÉ (P. P.). *Calotermes dispar*, **n. sp. Termite nouveau des îles Canaries. Le polymorphisme des soldats chez les Calotermitides.**—*Bull. Soc. ent. Fr.* **42** no. 20 pp. 291–295, 10 figs., 1 ref. Paris, 1938.

Descriptions are given of the royal pair and two forms of soldiers of *Calotermes dispar*, sp. n., from colonies found in chestnut and plum trees in the Canary Islands in June 1936. Dimorphism of soldiers exists in only a few species of Calotermitids. In the case of *C. dispar*, the two forms have distinct morphological differences, as well as being of different size.

FRAPPA (C.). **Description de** *Bemisia manihotis*, **n. sp. (Hem. Hom. Aleyrodidae) nuisible au manioc à Madagascar.**—*Bull. Soc. ent. Fr.* **43** no. 1–2 pp. 30–32, 1 fig., 1 ref. Paris, 1938.

Descriptions are given of the adult and larva of *Bemisia manihotis*, sp. n., which is abundant on the lower surface of leaves of cassava [*Manihot utilissima*] in Madagascar, where it was first observed in 1928. In some cases, the plants on which it occurred were suffering from mosaic ; in others, they were quite free from disease. No other food-plant is known.

LEPIGRE (A.). **Contribution à l'étude de la désinsectisation des grains par le mélange d'oxyde d'éthylène et d'acide carbonique. Notes sur le bromure de méthyle.**—*Bull. Soc. Enc. Industr. nat.* 1936 pp. 385–462, 31 figs., many refs. Paris, July 1936. [Recd. April 1938.]

It is impossible in an abstract to give more than an outline of the scope of this extensive paper, which deals chiefly with the fumigation of stored grain in Algeria with a mixture of ethylene oxide and carbon dioxide. The properties of ethylene oxide, the use of carbon dioxide to reduce inflammability, the various ways of introducing the gases into the grain silo, the spontaneous formation of carbon dioxide in the grain, and the forms in which it is obtainable commercially are discussed. It is considered that, to ensure non-inflammability, 12 parts carbon dioxide to 1 part ethylene oxide are necessary ; in experiments on *Tribolium castaneum*, Hbst. (*navale*, auct.), satisfactory kill was obtained with this mixture when the ethylene oxide was used at the rate of 2·3 oz. per 100 cu. ft. of grain. A figure and a description are given of an apparatus for automatically measuring and recording the absorption of gaseous ethylene oxide by the grain. Other subjects treated at some length include the influence of fumigation on the quality of flour from treated grain, the reduction it causes in the germinating power of seed grain, the effects of fumigated barley and oats on animals, the different ways of applying the treatment according to the nature of the premises and receptacles in which the grain is stored, the cost of treatment, and the resistance in large quantities of products ranging in size from beans to semolina to forced circulation of the gases. The question of possible loss through depreciation of the fumigation equipment, should a new and more satisfactory insecticide be discovered, is considered ; it is concluded that the equipment used for ethylene oxide would probably be suitable for use with any fumigant that replaced it.

A section is devoted to methyl bromide [*cf.* *R.A.E.*, A **23** 194 ; **24** 73] as a fumigant for grain. Its properties are given, and its action on man and higher animals is discussed, chiefly from the literature. The danger of its decomposition into hydrobromic acid in treated goods is thought to be considerable. Little is known of its influence on wheat for milling, but its effect on the germination of the grain is considered serious if a dosage of 6 oz. per 100 cu. ft. of air is used.

BOUHELIER (R.) & FOURY (A.). **L'emploi du trichloréthylène pour la désinfection des grains.**—*Rev. Path. vég.* **25** fasc. 1 pp. 5–25, 3 refs. Paris, 1938.

In further experiments on fumigation with trichlorethylene against insect pests of stored grain in France [*cf.* *R.A.E.*, A **25** 105], the fumigant was used at the rate of 1 pint per 100 cu. ft. for 48 hours, except where otherwise stated. In one experiment, alternate layers 4–6 ins. deep of heavily infested maize and uninfested wheat were placed in an air-tight vessel about 28 ins. deep and 14 ins. in diameter. The fumigant was poured on rags on the top layer of the maize and evaporated completely. All the numerous adults of *Calandra oryzae*, L., and *Tribolium castaneum*, Hbst., were killed, as also were a few larvae and pupae of the former, but some of the immature stages survived, as 5 adults of *C. oryzae* emerged during 3 months from samples of maize from the bottom layer. When infested wheat was fumigated in the same way, all adults of *C. oryzae* and *Tenebroides mauritanicus*, L., in the upper and middle part of the vessel were killed, but at a depth of 20–24 ins. 10 per cent. of the former survived. In 3 months, 22, 156 and 350 adults of *C. oryzae* and proportionate numbers of Hymenopterous parasites emerged from equal samples of grain from these 3 layers, respectively.

In another experiment, 6 small bags of infested wheat were each placed in a 220-lb. sack of wheat and treated in an air-tight fumigation tank with a capacity of about 140 cu. ft. at 11–18°C. [51·8–64·4°F.] and 80–90 per cent. humidity. The trichlorethylene was sprinkled over the sacks and volatilised completely. An open metal box containing lentils infested with *Bruchus lentis*, Fröl., was also placed in the tank. Adults and larvae of *C. oryzae*, larvae of *Sitotroga cerealella*, Ol., adults of *T. mauritanicus*, and adults, larvae and pupae of *B. lentis* were all killed. After 4 months, the insects emerging from the control comprised 138 adults of *C. oryzae* and 2 of *T. mauritanicus*, together with Hymenopterous parasites, and from the fumigated grain only 2 of *S. cerealella* ; the percentage germination in the two lots averaged

98·8 and 97·3, respectively. All larvae and pupae of *Bruchus rufimanus*, Boh., were killed in beans that were fumigated in a vessel holding about 5½ pints.

A concentration of the fumigant that was lethal for *C. oryzae* did not penetrate horizontally through wheat in a cylinder for more than 6 ins., but when the rate of application was raised to 5 pints, it penetrated for 8 ins. Thus any factor that would increase the diffusion of the gas would appreciably increase the efficiency of fumigation. Evaporation was complete in a few hours at 37–38°C. [98·6–100·4°F.] and in about 20 hours at 10–15°C. [50–59°F.] provided that the liquid was in a large container so that the surface area was large. All test insects were killed in these experiments, and the authors conclude that fumigation at medium or high temperatures with the maximum evaporating surface gives satisfactory mortality if the exposure is 48 hours and evaporation is complete in 24.

Previous conclusions on the persistence in grain of the smell of trichlorethylene [*loc. cit.*] were confirmed. Flour made from grain fumigated with normal or greatly increased concentrations retained the smell for some months in air-tight containers, for some days in open ones, and for not more than 24 hours when it was spread in the open air.

Germination of grain that had been in contact with the liquid before fumigation was reduced in proportion to the duration of contact, which shows that the fumigant should not be sprayed directly on it. The fumes appear to have no harmful effect on man unless they are concentrated and inhaled for some time. Rats and dogs were not affected by prolonged and repeated exposure to a concentration of 0·2 per cent.

BALACHOWSKY (A.). **Le doryphore de la pomme de terre et la douce-amère.**—*Rev. Path. vég.* **25** fasc. 1 pp. 26–28, 1 ref. Paris, 1938.

In the summer of 1937, the author found *Leptinotarsa* (*Chrysomela*) *decemlineata*, Say, breeding actively on *Solanum dulcamara* in places where there were no potatoes in the departments of Indre-et-Loire and Deux-Sèvres in France. Larvae in all instars were observed on the plants and pupae under them. He considers that the wide distribution of this species of *Solanum* is likely to facilitate the spread of the beetle in Europe and into Asia.

SUIRE (J.). **Sur un geste dysharmonique des chenilles de cochylis** (*Clysia ambiguella* **Hb.**).—*Rev. Path. vég.* **25** fasc. 1 pp. 29–30, 1 fig. Paris, 1938.

In August 1936, several varieties of vines on an island off the west coast of France were heavily infested by larvae of *Clysia ambiguella*, Hb. The Tachinid, *Phytomyptera nitidiventris*, Rond., was the only parasite obtained from them. Of 55 larvae of *C. ambiguella* reared under dry conditions, 32 made cases for pupation from the skins of the grapes; 75 per cent. of the larvae did not turn round in the cases before pupating, and the adults were therefore unable to emerge. Similar cases were observed in the field following a period of dry weather, and many of them also contained dead adults.

Lesne (P.). **Un nouveau foyer de multiplication de la mouche des fruits** (*Ceratitis capitata*, **Wied.**) **aux environs de Paris.**—*Rev. Path. vég.* **25** fasc. 1 pp. 31–32, 1 ref. Paris, 1938.

Brief notes are given on infestation of peaches, pears and apples by *Ceratitis capitata*, Wied., near Paris [*cf. R.A.E.*, A **22** 118]. Third-instar larvae were found at the end of October 1936 as well as numerous pupae, some of which gave rise to adults in the same month.

Frappa (M. C.). **Recherches sur l'action de la température et de l'humidité sur le comportement du criquet migrateur** (*Locusta migratoria capito* **Sauss.**) **à Madagascar.**—*Rev. Path. vég.* **25** fasc. 1 pp. 46–58, 4 refs. Paris, 1938.

In 1935, a series of laboratory experiments were carried out at Tananarive on the influence of temperature and humidity on the development of *Locusta migratoria capito*, Sauss.

Eggs from egg-pods collected in a locality in south-western Madagascar were mixed into different lots and exposed to different combinations of temperature and humidity. Exposure to temperatures of 25–28°C. [77–82·4°F.] and 32–34°C. [89·6–93·2°F.] at 100 per cent. relative humidity invariably activated and accelerated embryonic development, the shortest period being observed in the case of eggs collected on 17th June and subjected to 32–34°C. from 1st July, which hatched on 7th and 8th July. A diapause was induced in eggs kept at temperatures of 16°C. [60·8°F.] by night and 21°C. [69·8°F.] by day and a relative humidity of 60 per cent. Average temperatures and humidities in the outbreak centre in southern and south-western Madagascar [*cf. R.A.E.*, A **22** 8] suggest that an embryonic diapause lasting 40–60 days probably occurs there between May and August.

The development of hoppers kept in a saturated atmosphere at constant temperatures of 27·5°C. [81·5°F.] and 33°C. lasted 32–46 and 20–23 days, respectively.

Brémond (P.). **Recherches sur la biologie de** *Lixus junci* **Boeh. charançon nuisible à la betterave au Maroc.**—*Rev. Path. vég.* **25** fasc. 1 pp. 59–73, 1 pl., 7 figs. Paris, 1938.

The chief pests of beet in Morocco are *Cassida vittata*, Vill., *Phthorimaea ocellatella*, Boyd, and *Lixus junci*, Boh. Adults of *L. junci* begin to emerge from hibernation in January and pair at the end of February. The adults of the first generation appear at the end of May and reach their maximum numbers at the end of June. Those of the second generation emerge at the end of August and the beginning of September. They feed until the end of October, and some then hibernate in undergrowth or under plant débris, while others pair during the first rains and oviposit on beet left in the fields, or on wild beet. The adults of a partial third generation emerge on sunny days and enter hibernation almost immediately if the weather becomes cold. The egg, larval and pupal stages last about 4–5, 30 and a minimum of 15 days, respectively.

On emergence from hibernation the weevils move to the young beet plants, which are then about 8 inches high. Pairing does not take place for about 15 days, and oviposition begins 3 days later. The eggs are deposited singly, at the rate of 2–3 per day, in the petioles. The larva begins to feed on the tissues of the petiole and then eats out a gallery to the base of the leaf and sometimes into the root. The adults feed on both surfaces of the leaf margins, but cause less damage than the larvae. Infestation is most serious in dry weather, when the leaves remain small and most of the development takes place in the root. Two or three larvae may then cause the whole of the upper part of a root to rot. In a wet weason, the leaves grow rapidly and pupation occurs before the larvae penetrate into the root. The larvae and pupae then remain within the reach of various Hymenopterous parasites, and rapid growth may weaken the wall of the larval gallery, which ruptures, allowing the rain to enter. In the spring of 1936, about 50 per cent. of the larvae were killed in this way by the abnormally heavy rainfall.

The bionomics of *Lixus scabricollis*, Boh., and *L. brevirostris*, Boh., are similar to those of *L. junci*, but the generations overlap and all stages occur together, except in winter. The larvae, however, do not leave the petioles.

Of 352 larvae of *L. junci* collected in July, 152 were parasitised by *Microbracon* (*Bracon*) *intercessor*, Nees, and 36 by *Picroscytoides cerasiops*, Masi ; the eggs were parasitised by the Pteromalid, *Habrocytus lixi*, Sarra. Other parasites of the larvae included the Tachinid, *Zeuxia nigripes*, Macq., and a species of *Anilastus*. The Ephydrid, *Psilopa nitidula compta*, Mg., was also found with larvae of *L. junci*, but it is not known whether it is a true parasite or a commensal. *L. scabricollis* and *L. brevirostris* were also parasitised by *P. cerasiops* and *H. lixi*. All stages of these two parasites are described. Adults of *P. cerasiops*, which live for 25–30 days, begin to appear in mid-June and are abundant in late July and August. Their numbers are then reduced, as many of the larvae are destroyed by hyperparasites. The period from the end of September to the following June is passed in the pupal stage. In summer the egg, larval and pupal stages lasted 2, 8–10 and 10–12 days, respectively. Under laboratory conditions, pairing and oviposition only occurred when the breeding cages were placed in the sun. At 25°C. [77°F.] only 2–3 eggs were laid daily, and at 18°C. [64·4°F.], which is quite a usual summer temperature on the Atlantic coast, oviposition ceased. The female paralyses the larva and deposits an egg either on it or on the wall of the gallery. The parasite is ectophagous, and pupates in the gallery of the host. The pupae are parasitised by *Eurytoma curculionum*, Mayr, and *E. tristis*, Mayr. *P. cerasiops* is a much less important parasite than *M. intercessor*, the life-cycle of which is completed in half the time. The adults of *H. lixi* are first seen about mid-June and disappear at the end of August, probably on account of parasitism of the early stages. Pairing takes place on the day of emergence and oviposition next day. The life-cycle is completed in 15–20 days. In some plots, from 30 to 75 per cent. of the eggs of *Lixus* were parasitised by this Pteromalid in June.

PERRET (J.). **Observations complémentaires sur la biologie d'***Epilachna chrysomelina* **Fabr. au Maroc (Coccinelle du melon).**—*Rev. Path. vég.* **25** fasc. 1 pp. 74–80, 1 fig., 1 ref. Paris, 1938.

An account is given of further work on the bionomics of *Epilachna chrysomelina*, F., on melon in Morocco [*cf. R.A.E.*, A **24** 680], including the results of rearing at known temperatures. It was found that the durations of the various stages were more variable than had been supposed, that in summer a single female laid a maximum of about 400 eggs, and that in 1936 there were four generations with a partial fifth [*cf. loc. cit.*]. In that year, hibernation did not begin until October and some adults were still active at the end of November. Breeding does not, however, occur between October and March.

MORISON (G. D.). **The Heather Beetle** (*Lochmaea suturalis* **Thomson).**—11 pp., 5 figs. Aberdeen, N. Scotl. Coll. Agric., 1938.

A brief account is given of the bionomics of the Galerucid, *Lochmaea suturalis*, Thoms., the injury it causes to heather (*Calluna vulgaris*) and possible methods of controlling it [*cf. R.A.E.*, A **24** 362, 641, etc.]. Its only food-plant other than *C. vulgaris* is bell heather (*Erica cinerea*) and the latter is very seldom attacked. The way in which heather grows and its reaction to burning and to damage by the insect are described. Normally the latter is of no economic importance, but there are irregular cycles of attack, which usually follow an abnormally low rainfall during June–August for two or three years in succession, which hinders the growth of the plant. In north-eastern Scotland the infestation reached a peak following the dry periods of 1933–35, and has since diminished. As an outbreak requires two or more years to develop, it might be prevented by dusting with derris or pyrethrum while the infested area is still small. The dusts should be applied during a spell of dry weather when the larvae are feeding on the bushes during July–August, they can be scattered by hand, by special machines, or by a manure-distributing machine if the country is suitable for its use. Where the law permits burning heather during July–August (which is not allowed in Scotland), the small infested areas might be burnt, if there is enough labour to control the fire and if there is no risk of setting the peat on fire.

ABRAHAM (R.). **Die Entwicklung der Kartoffelkäferbekämpfung in Deutschland.** [The Development in Germany of Measures against the Potato Beetle.]—*Z. PflKrankh.* **48** no. 3 pp. 97–118, 16 refs. Stuttgart, 1938.

A brief account is given of the occurrence of *Leptinotarsa decemlineata*, Say, on potato in Germany in 1877, 1914 and 1934–37 [*cf. R.A.E.*, A **22** 560], and the control measures applied at these dates are compared. The Chrysomelid was observed in 26 communes near the western frontier in 1936 and in 35 in 1937 [*cf.* **26** 120, etc.]. In these two years, all potato fields in infested areas were searched regularly, all individuals found were collected, the infested plants were placed in trenches, soaked with carbon bisulphide and covered with earth, and carbon bisulphide was also used to fumigate the soil. Plants left in the fields or in adjoining potato fields were sprayed about once a fortnight with calcium arsenate (4 lb. per 100 gals.), and other potato fields within 1¼ miles were sprayed 2–4 times during the summer. Trap trenches [**22** 561] were not required. Two preventive applications of spray were made throughout a region comprising 571 communes in the Rhineland and Saar Palatinate.

GÖTZ (B.) & STELLWAAG (F.). **Das Verhalten des Traubenwicklers** *Clysia ambiguella* **bei der Wahl des Winterverpuppungsplatzes und die Möglichkeiten für die Bekämpfung.** [The Behaviour of the Vine Moth, *C. ambiguella*, in its Choice of a Winter Refuge for Pupation and the Possibilities for Control.]—*Z. PflKrankh.* **48** no. 3 pp. 128–144, 4 figs., 43 refs. Stuttgart, 1938.

This paper is one of a series on experiments connected with the possibility of control of the vine-moths, *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., in Germany by methods that do not involve the use of arsenicals [*cf. R.A.E.*, A **26** 154]. It comprises an account of investigations on the factors influencing larvae of *C. ambiguella* in their choice of shelter in which to pupate and hibernate, carried out with a view to improving traps, which have hitherto proved ineffective against them. The experiments showed that the larvae seek dark places and select wood for pupation ; they avoided leaves and only rarely pupated on stones or on the soil. Angles were preferred to plane surfaces and acute angles to obtuse. The degree of slope of the shelter was immaterial. The larvae were apparently first attracted by darkness and wood, and then sought shelters of a certain width, preferably cracks 1·8 mm. wide.

Trap-bands are considered promising if dark and containing numerous shelters 1·8–2 mm. in width. As the larvae tend to spin their cocoons quite close to others already made, it might be possible to enhance the attractiveness of the bands by allowing the moths to emerge in a cage and then using the bands again without removing the webs. Experimental work is still needed, however, to ascertain the practical value of even the most favourable traps.

NITSCHE (G.) & KOSSWIG (W.). **Zur Bekämpfung der Rübenblattwanze** (*Piesma quadratum* **Fieb.**) **VII.** [Control of the Beet Leaf Bug, *P. quadratum*. VII.]—*Z. PflKrankh.* **48** no. 3 pp. 144–151, 2 figs., 6 refs. Stuttgart, 1938.

Observations in Silesia on the control of *Piesma quadratum*, Fieb., were continued in 1937 [*cf. R.A.E.*, A **25** 729, 581]. The flight began on 2nd May, reached its peak in 4 days, and was almost over by 16th. It was therefore possible to sow the beet fields on 15th May and to plough in the trap-strips 4 days later. In 1937 migration from the winter quarters was mainly by flight. The trap-strips, most of which were round and not in the fields, gave excellent control, and the incidence of the crinkle disease amounted to only 0·5 per cent. in 1937 as compared with 3 per cent. in the autumn of 1936. In view of the reduction in infestation by the Tingid, the decision whether to apply control measures should be taken in future by the individual communes.

JANISCH (E.). **Eine neue Pilzkrankheit bei Nonnenraupen.** [A new Fungous Disease of Nun Moth Larvae.]—*Arb. physiol. angew. Ent. Berl.* **5** no 1 pp. 1–20, 9 figs., 18 refs. Berlin, 8th March 1938.

The following is based on the author's summary : Larvae of the nun moth [*Lymantria monacha*, L.] bred from eggs collected near Berlin in a stand of old pines interspersed with old beech trees were killed in March 1937 by a disease caused by *Aspergillus versicolor*, a fungus not previously recorded as pathogenic. In experiments in the laboratory under various conditions of temperature, humidity and feeding, individuals dusted in the larval stage with the spores all became infested and died, though some lived long enough to become pupae or even adults. Larvae killed by the fungus were also found on trees that had been dusted with spores in the field. Young larvae fed on oak leaves were less resistant than those on pine needles. Resistance decreased as environmental conditions deviated from the optimum. The disease was characterised externally by a crippling of the prolegs, particularly after a moult. The time within which the larvae died depended on the number of spores on their skin. In preliminary experiments, *A. versicolor* was pathogenic to larvae of *Bombyx mori*, L., *Panolis flammea*, Schiff., and *Bupalus piniarius*, L.

HADERSOLD (O.). **Ergebnisse von Parasiten-Zuchten der Zweigstelle Stade der Biologischen Reichsanstalt für Land- u. Forstwirtschaft. I. Teil: Ichneumonidae.** [The Results of Rearing Parasites at the Stade Branch of the Imperial Biological Institute for Agriculture and Forestry. Part I. ICHNEUMONIDAE.]—*Arb. physiol. angew. Ent. Berl.* **5** no. 1 pp. 21–32, 1 fig., 7 refs. Berlin, 8th March 1938.

A list is given of 40 Ichneumonid parasites bred since 1926 from insect pests of fruit and other trees and plants at Stade in the Lower Elbe region. The parasites are arranged in their subfamilies, and their dates of emergence and hosts and the food-plants of the latter are recorded.

SPEYER (W.). **Ueber das Vorkommen von Lokalrassen des Kleinen Frostspanners** (*Cheimatobia brumata* **L.**). **Ein Beitrag zur Verständnis der verschiedenen Flugzeiten.** [On the Occurrence of local Races of the Lesser Winter Moth, *Operophtera brumata*, L. A Contribution to the Understanding of the various Flight Periods.] —*Arb. physiol. angew. Ent. Berl.* **5** no. 1 pp. 50–76, 6 figs., 16 refs. Berlin, 8th March 1938.

Since 1920, investigations have been carried out at Naumburg a.d. Saale and in the Lower Elbe region on the occurrence of local races and the dates of emergence of the adults of *Operophtera* (*Cheimatobia*) *brumata*, L. [*cf.* *R.A.E.*, A **26** 52]. A knowledge of the date of emergence is of practical importance as it enables adhesive bands to be applied at the correct date to the fruit trees.

The following is based on the author's summary: Owing to the effect of soil and climate and the inability of the females to fly, *O. brumata* has formed innumerable local races with peculiarities, especially as regards date of emergence, that are maintained through years of breeding [*cf.* **21** 174, 527; **23** 717]. Variations in them are possible by selection, and occasional mutants that emerge early or late enable the local races to adapt themselves to changes in climate. The date of adult emergence in autumn is correlated with that of larval hatching. The male larvae and pupae are more sensitive than the female, so that unfavourable conditions lead to a predominance of female adults [*cf.* **21** 527], but this is of little importance as males can pair up to 7 times.

There is no interruption of physiological processes in the pupae, and prolonged diapause has not been observed. The rate of development of the pupae, unlike that of the eggs and larvae, is not affected by temperature to any extent; short periods of temperatures higher or lower than normal have no effect, but a long exposure always retards emergence. The changes that take place in the pupa are thought to proceed in hereditarily determined ways, possibly under the influence of catalytic ferments or hormones of which the action is released by some impulse. Alternatively, pupation may lead to the partial or total suspension of the action of some ferment or similar agent that renders effective the action of temperature on the larvae, only extremes of temperature having an effect, which is necessarily harmful, on the pupae.

HANF (M.). **Die Bekämpfung des Apfelblütenstechers.** [The Control of the Apple Blossom Weevil.]—*Kranke Pflanze* **15** pt. 3 pp. 41–46, 3 figs. Dresden, March 1938.

The author has collated the results of investigations on the control of *Anthonomus pomorum*, L., in Germany by the late Dr. F. Sattler, whose preliminary note has been already noticed [*R.A.E.*, A **25** 486]. Details are given of the experiments with various proprietary insecticides containing quassia, derris, pyrethrum and nicotine. It is possible to reduce infestation of the apple blossoms by 60–80 per cent. If the weevils are abundant, pyrethrum or pyrethrum-derris should be added to the usual pre-blossom spray, which should be applied with a fine nozzle soon after the first green appears in the buds. A second application is necessary if the pre-blossom period is protracted. In small orchards, bands should be fixed in mid-June to catch the survivors entering their winter-quarters. These should be collected and destroyed in September.

JANCKE (O.) & MAERCKS (H.). **Ueber die Wirkungsdauer von Berührungsgiften. (Vorläufige Mitteilung.)** [On the Duration of the Activity of Contact Poisons. (Preliminary Communication.)]—*NachrBl. dtsch. PflSchDienst* **18** no. 3 pp. 23–24. Berlin, March 1938.

An account is given of laboratory experiments in Germany to determine the length of time during which sprays of nicotine and sprays or dusts of pyrethrum or derris remain active. The insecticides were applied at usual concentrations to glass dishes and test insects were placed in them at known intervals after the application, left there for about an hour (uncovered so as to preclude any fumigant action), and then removed to unpoisoned food in clean dishes. The mortality was ascertained after 2 days. The results are tabulated.

When batches of 30 larvae of *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, auct.) were placed in the dishes 1½, 5, 6½ and 24 hours after application of crude nicotine and soap, the numbers that died were 22, 0, 1 and 0, respectively. The corresponding figures for one of three other nicotine preparations were 24, 7, 6 and 1, the two others giving poor results.

In another series of experiments, batches of varying numbers of larvae of the vine moth, *Polychrosis botrana*, Schiff., were similarly tested or sprayed directly. When they were sprayed directly, the mortality was estimated after 3 days and was similar (between 70 and 81 per cent.) for crude nicotine and soap, tobacco extract and soap, and preparations of pyrethrum or pyrethrum and derris. When tested by the first method, the tobacco extract was the most effective spray, giving 75 and 40 per cent. mortality of larvae placed in the dishes 2 and 24 hours after application. The sprays of pyrethrum and pyrethrum-derris were disappointing; the latter gave no mortality. Pyrethrum dust and pyrethrum-derris dust gave percentage mortalities of 100 and 79, respectively, when the interval was 2 hours. A derris dust gave 100 per cent. mortality when the intervals were 2 and 6 hours, and 95 per cent. when they were 24 and 48 hours.

Summary of the Scientific Research Work of the Institute of Plant Protection for the Year 1936. Part I. Pests and Diseases of Cereals and Shelterbelts. [*In Russian.*]—Roy. 8vo, 252 pp., 27 graphs, 8 diagr., 4 maps, 9 figs., 10 refs. Leningrad, Lenin Acad. agric. Sci., 1937. Price 8 *rub.* 50 *kop.* [Recd. April 1938.]

This collection of summaries of reports by various authors on work in 1936 is divided into two sections, of which the first (pp. 3–185) deals with pest or diseases of cereals observed in the Russian Union, and the second (pp. 186–246) with pests and diseases associated with protective strips of trees that have been planted along the edges of fields in the steppe. The following summaries deal with pests.

OSTROVSKIĬ (N. I.). **Effect of Soil Moisture on the Number and Development of Storehouse Mites** (pp. 14–16). Investigations on the survival of grain mites under field conditions were carried out in the Province of Voronezh. Systematic examination of plants and soil taken from plots artificially infested with mites showed that their numbers decrease sharply as the soil becomes drier, especially at the end of July and in August. Of the species found on winter and spring sown cereals, *Tyrophagus putrescentiae*, Schr., was the commonest. The unfavourable effect on the mites of dry conditions was confirmed in experiments in which artificially infested seeds of oats and summer wheat were sown in pots in soil of which the moisture content was constant. Some pots contained soil with mites but no seeds. Periodical examination of a few plants at a time and of the soil showed that the mites were most abundant when the moisture content of the soil was 70 per cent.; only single individuals occurred when it was 40 per cent., and none when it was 20 per cent. In pots without plants, mites occurred only in soil of 70 per cent. moisture content. It is concluded that in dry and hot years only negligible numbers of mites would occur in the field at harvest time, and that infestation of newly threshed grain can take place only in damp years.

GRIVANOV (K. P.). **Distribution of *Euxoa segetum* Schiff. in Relation to Soil Conditions** (pp. 16–22). With a view to determining the factors that cause larvae of *Euxoa segetum*, Schiff., to congregate in sharply defined foci during an outbreak, their distribution in the soil was studied in 12 districts in the Province of Kharkov. Their presence was found to depend primarily on the type and physical structure of the soil, and they were always most abundant in light soil with a loose, soft and granulous upper layer of normal humidity (clay-sand and black soil), these conditions being the most favourable for their development. They do not survive in soils of heavy clayey or saline type with a hard compact upper layer, or in sand, meadow land or marshes. The foci of infestation occurred, therefore, chiefly in light sandy black soil on the second terrace of the river valleys. This tendency was confirmed in field experiments on the survival of newly hatched larvae liberated in eight plots that greatly differed ecologically. Survival after 35–38 days was greatest in clean fallow with well loosened soil, decreasing in the other plots as the soil varied to the more compact and hard types. The topography of the area of infestation affects the distribution of the larvae, as the adult moths concentrate during the period of oviposition in localities where temperature conditions are nearest to the optimum. Thus, during a period of hot weather in July, the ovipositing moths congregated at night in valleys as the temperature there was lower, and consequently the larvae were more abundant in the valley than on the plateau. But in August, when it was rather cold in the valleys at night, the moths congregated and oviposited in higher-lying places.

GRIVANOV (K. P.). **The Effect of meteorological Conditions upon the Behaviour of** *Euxoa segetum* **Schiff.** (pp. 22–28). Observations in the Province of Kharkov during the flight period of the adults of the summer generation of *Euxoa segetum*, Schiff., which lasted from 20th July to 1st October, showed that the times of the beginning and end of the flight depend chiefly on the intensity of the light and then on the force and direction of the wind ; humidity of the air and temperature were without effect. The flight is at its maximum between 9 p.m. and midnight and finishes towards 4 a.m. Its intensity, however, is affected by temperature as well as wind, practically no moths being on the wing on cold nights or when the velocity of the wind was more than 10 ft. per second. Catches of moths in traps baited with molasses showed that they are most abundant at a height of 6½ ft. or more ; the smallest numbers occurred at a height of 1½ ft. This is due to the inversion of temperature at night, the air being cooler near the ground. In hot weather the moths were on the wing chiefly in valleys, whereas at low temperatures the flight definitely increased at higher elevations [see preceding abstract]. Under similar conditions of relief, the flight of the moths did not vary in different types of habitat. They oviposited indiscriminately in places that greatly differed ecologically and included unsuitable land with hard compact soil, devoid of vegetation, or with stubble [*cf. R.A.E.*, A **25** 142], under which conditions the resultant larvae would not be able to survive.

KOZHANCHIKOV (I.), RZHECHITZKAYA (Yu.) & VOLODINA (G.). **The Rôle of ecological Factors in the Fecundity of** *Euxoa segetum* **Schiff.** (pp. 28–30). Laboratory experiments showed that females of *Euxoa segetum*, Schiff., reared as larvae on beet at 22°C. [71·6°F.] and 85 per cent. relative humidity survive and oviposit at temperatures ranging from 7 to 23°C.[44·6–73·4°F.], the optimum being 20–22°C. [68–71·6°F.]. At high temperatures, the females do not live so long and apparently do not pair, for 99 per cent. were usually fertilised at 7–20°C. [44·6–68°F.] and only 20 per cent. at 28°C. [82·4°F.]. The average number of eggs per female was highest (314) at 20°C., though the maximum (1,202) was laid at 12·5°C. [54·5°F.]. No oviposition took place at 32°C. [89·6°F.]. The average number of eggs deposited by females kept at 20°C. for 18 hours and then at 32°C. for 6 hours was 139. Under conditions of high humidity many females did not oviposit. The fertility of females depended greatly on what food they had had as larvae [*cf.* **25** 138]; those reared on *Chenopodium album* laid an average of 937 eggs, with a maximum of 1,690, compared with 81 and 292, respectively, for those reared on maize. Feeding in the adult stage was also important; the number of eggs deposited by individuals fed on 40 per cent. glucose averaged 376, as compared with 43, 158 and 66, respectively, for those fed on 5 per cent. glucose, given water only or kept without food or water.

KREĬTER (E. A.). **Conditions limiting the Multiplication of** *Euxoa segetum* **Schiff. in the arid Steppe Region** (pp. 30–33). Investigations on the development of *Euxoa segetum*, Schiff., were carried out in a district on the river Don in North Caucasus, where the climate is usually dry and outbreaks occur only when a damp September, which favours the hibernating larvae, is followed by a damp May, which favours the development of the pupae [*cf.* **25** 504]. In 1936, as a result of the dry weather, only a few adults were on the wing at the end of May and again in the second half of July, and the number of larvae that entered hibernation was very small. In experiments in which the larvae were fed on different plants, development was quickest and the resulting pupae were heaviest when the food-plant was potato, whereas the slowest development and the lightest pupae resulted on autumn-sown wheat. Of the females obtained, those from either series that were allowed to feed on 5 per cent. sugar solution lived almost twice as long as those given water only and laid more eggs, the average number produced by females reared on potato being 1,098 and 288·2, respectively, while those reared on wheat produced 713·2 and 0.

SKOBLO (I. S.). **On the Fecundity and Longevity of adult** *Euxoa segetum* **Schiff.** (pp. 34–36). In view of the fact that the fecundity of females of *Euxoa segetum*, Schiff., has been found to depend on larval feeding [*cf.* **25** 139], experiments were carried out in Leningrad at 20–25°C. [68–77°F.] and 50–60 per cent. relative humidity to determine the relative effects on fecundity of feeding in the larval and adult stages. The larvae were fed on *Atriplex*, potato, beet, onion or *Sonchus*, and the resulting adults were given water or a 10 or 50 per cent. solution of saccharose. The fecundity and longevity of the females did not vary with the food-plant of the larvae, though the duration of the larval stage was affected. Of the females that were given saccharose, those from larvae fed on potato deposited an average of 678·6 eggs each [*cf.* preceding abstract]. On the other hand, there existed a direct relation between the weight of the pupae and the fertility of the moths fed on the saccharose solution, and the fecundity of such females was 4–8 times as high as that of individuals given water only. As in the case of *Loxostege sticticalis*, L. [**25** 277], there was no correlation between pupal weight and the longevity of females fed on saccharose, but the concentration of the solution did not affect their fecundity to any appreciable extent. Their average longevity, however, was considerably greater than that of individuals given water only; this was particularly evident in small individuals resulting from light pupae.

VOLGIN (V. I.). **Wireworms of the Smolensk District and their Relation to Crop Rotation and Soil Conditions** (pp. 36–41). Of 9 species of wireworms found in the soil in different localities in the Province of Smolensk in 1935 and 1936, 72·1 per cent. were (in descending order of abundance) *Agriotes obscurus*, L., *A. lineatus*, L., and *A. sputator*, L. The distribution of the larvae depended largely on the type of soil. Thus, *A. obscurus* and *Corymbites* (*Selatosomus*) *aeneus*, L., preferred lighter and *A. lineatus* heavier soils; *A. sputator* and *Athous niger*, L., were found only in clayey arable land, in which *Adrastus limbatus*, F., was also fairly common; while *Limonius aeruginosus*, Ol., occurred in sandy arable fields, and *Corymbites sjaelandicus*, Müll., in meadows and low-lying places. On the whole, meadows and fallow were considerably less infested than arable land. In the latter, the distribution of the wireworms was again uneven, clover fields, especially those in which first-year clover was mixed with cereals, being most infested. Young clover evidently attracts the adult beetles, and this was proved in special experiments in which they preferred this crop to any other cultivated plants. In fields in which clover and cereals are mixed, they find favourable conditions for oviposition and shelter, and the comparative looseness and softness of the soil are favourable for the larvae. Fields of second- and third-year clover are infested somewhat less, owing to the soil being compact and similar to that in meadow land.

MERKUL'EVA (A.). **Wireworms of Cherepovetz District, Leningrad Region** (pp. 41–43). Of 7 Elaterids found in the district of Cherepovetz in the eastern part of the Province of Leningrad, *Agriotes obscurus*, L., was the most abundant, occurring in medium clay soils, and in peaty arable and meadow lands. *A. lineatus*, L., which was next in abundance, was chiefly found in heavy clay soil, and *Corymbites* (*Selatosomus*) *aeneus*, L., predominated in sandy plots. Clayey and recently ploughed semi-peat lands were the most severely infested by wireworms, whereas plots in which trees had recently been uprooted contained the smallest numbers. In recently ploughed fields, the numbers increased in direct proportion to the abundance of *Agropyrum repens*. The injury to wheat increased as more larvae occurred in the soil, but the dates of sowing had little effect on the degree of infestation.

BOBINSKAYA (S. G.). **The Effect of Soil Conditions upon the Behaviour of the Wireworms** *Agriotes obscurus* **L.** (pp. 43–46). Regular examination in the district of Cherepovetz of samples of soil from selected plots under different crops in different years showed that the adults of *Agriotes obscurus*, L., oviposit chiefly in clay soils with a considerable admixture of ashes from burnt forests. The depth of the larvae in the soil was found to depend not only on its moisture content, 50–60 per cent. being the most favourable [*cf.* **25** 138], but also on its acidity, which in turn depends on the crop sown. The majority of wireworms occurred in layers of which the pH was less than 6, very few being found in less acid layers. Autumn downward migrations depended mainly on the temperature of the soil, starting when it was 9°C. [48·2°F.] at a depth of 2 ins.; when the temperature of the upper layer dropped to 6–7°C. [42·8–44·6°F.], the wireworms descended to a depth of 18 ins., and about the end of November, when the soil was frozen to a depth of 10 ins., they occurred at 20–24 ins. In the spring, injury to crops was first observed when the mean temperature of the soil was 11°C. [51·8°F.].

POSPELOVA (V.). **Study of the Wireworms of Tomsk District, West Siberian Region** (pp. 46–48). A brief account, based on data from the literature and collections, is given of the distribution and economic importance of wireworms in western Siberia. *Corymbites* (*Selatosomus*) *latus*, F., *C.* (*S.*) *spretus*, Mannh., and *C.* (*S.*) *aeneus*, L., predominate in the steppe and forest-steppe areas, whereas *Agriotes obscurus*, L., *A. sputator*, L., and *A. lineatus*, L., are prevalent in the northern part adjoining the marshy forest region, as well as in southern districts situated at the foot of the mountains. In the Province of Tomsk, in the forest zone of Siberia, the wireworms chiefly attack vegetable crops, causing considerable losses. They usually concentrate on ploughed land, preferring well manured soils or those rich in humus. Weedy plots, when overgrown with *Agropyrum repens*, are more infested. *A. obscurus* is the most injurious species. Vertical migrations in the soil take place during the whole summer and depend on moisture content. Hibernation occurs at depths of as much as 40 ins.

Rubtzov (I. A.). **Bio-climatic Zonation of** ***Aeropus sibiricus sibiricus*** **L.** (pp. 48–51). In the Russian Union, the distribution of *Aeropus sibiricus*, L., coincides with the forest-steppe and part of the steppe regions and is bounded in the north by the 56th parallel from the Volga to the river Argun. On the whole, it is injurious only in areas with a pronounced continental climate in which wheat is intensively cultivated. The largest reservations [*cf.* **24** 354] occur chiefly in river valleys, but in Siberia they are usually found on plateaux at altitudes of some 1,300–2,300 ft. The increase of the grasshopper is chiefly dependent on precipitation in May and September. The most favourable habitats for mass propagation are pastures and, to a less extent, fallow and waste land, provided that the soil is light and permeable and the vegetation sparse, varied and ephemeral. In the reservations, the numbers of *A. sibiricus* increase with the onset of drier conditions, which are unfavourable to fungous egg parasites [*cf.* **24** 355], and excessive grazing, which destroys the vegetative cover and leads to the desiccation of the upper layer of the soil.

Kozlova (E. N.). **The Use of improved Preparations for Aero-dusting in the Control of** ***Locusta migratoria*** **L.** (pp. 51–53). In experiments in southern Kazakstan with dusts of calcium arsenite applied from aeroplanes against *Locusta migratoria*, L., spindle oil mixed with the dust at the rate of 4 per cent. by weight invariably increased its effectiveness, even when it was applied at a lower rate [*cf.* **25** 130]. Thus, the calcium arsenite alone gave 83·2 per cent. mortality when applied at the rate of 4·5 lb. per acre, whereas the oil-impregnated dust gave 95·9 per cent. when applied at the rate of 2 lb. The addition of oil decreases the amount of dust released from the aeroplane in a unit of time by almost 30 per cent. It appears that the best amount of spindle oil to add to the calcium arsenite is 4–5 per cent. by weight.

Il'inskiĭ (A. M.). **The Use of black Cyanide in controlling Locusts** (pp. 53–56). The experiments described were carried out in June 1936 against the hoppers of *Locusta migratoria*, L., in southern Kazakstan with calcium cyanide (about 20 per cent. HCN) used in the form of flakes, granules or dust. In the case of stationary swarms, plots were marked off in the infested area, and the calcium cyanide was applied with a hand duster or was strewn by hand. In the case of moving swarms, the calcium cyanide was strewn on strips of moistened soil 10–16 ft. wide at some distance in front of the swarm; to prevent the locusts from turning aside, the ends of the strips were bent inwards in the shape of a horseshoe. It was found that 2 hours after the application of the calcium cyanide, only 15–25 per cent. of the HCN had vaporised, but even this small amount proved highly effective under optimum conditions. The use of barrier strips proved to be the most effective method, as either the whole swarm is killed or the migration is stopped by the death of the hoppers in front. Against the stationary swarms, the dust was more effective and more economical than the granules, which usually killed only the younger hoppers. It required 3 oz. granules per sq. yard to give 96·9 per cent. mortality of hoppers of the first four instars under the most favourable conditions encountered (100 per cent. humidity at 18–20·8°C. [64·4–69·44°F.]). Locusts resting on plants usually survive even high dosages of granular calcium cyanide. Flaked calcium cyanide gave poor results.

Zhukovskiĭ (A. V.). **The Significance of Crop Rotation and Methods of Cultivation in controlling the Swedish Fly** (pp. 56–58). In the course of observations on *Oscinella frit*, L., in the Province of Voronezh, examination of the soil in a field of spring-sown wheat at the time of sprouting revealed the presence of large numbers of the larvae and puparia, the former occurring at a depth of 4–4½ ins. and the latter in the upper dry layer of the soil. In the preceding year the field had been used for wheat, and after the harvest it became overgrown with self-sown plants and *Agropyrum repens*, which in August and September were severely infested. Autumn ploughing to a depth of 4½–6 ins. had been too shallow to destroy the larvae in the soil. In two other localities, fields of barley situated close to a plot overgrown with *A. repens* and to a threshing-ground overgrown with self-sown wheat, respectively, became severely infested. It is suggested, therefore, that barley or summer wheat should not be sown after cereals. On one farm, the second generation of the fly infested 71 per cent. of the plants in a field of *Phalaris canariensis*. The plants were in the tillering stage and more attractive than the neighbouring barley and summer wheat on which the first generation had developed, the stems of which had become too coarse.

Guseva (A.). **The developmental Period of *Phorbia genitalis* Schnabl in Voronezh Region** (pp. 58–60). Of recent years, *Phorbia genitalis*, Schnabl, has increased considerably in the Black-soil Zone, and observations were carried out in the eastern part of the Province of Voronezh in 1936 to determine the effect of date of sowing on infestation of summer wheat [*cf.* **25** 143]. The adults appeared on 11th May and most of the larvae hatched 8 days later. The highest infestation (7·8 per cent. injured plants) occurred on wheat sown early (25th April), because the plants were in the most susceptible phase during the adult flight. The crop sown two days later was only slightly attacked, and that sown on 4th May escaped infestation. The percentage of injury increased in proportion to the density of the crop.

Zhukovskiĭ (A. V.). **Peculiarities in the Development of the Stem Flea Beetles (*Chaetocnema aridula* Gyll. and *Chaetocnema hortensis* Geoffr.) and their economic Significance for Spring Wheat in the Voronezh Region** (pp. 60–62). In the Province of Voronezh, *Chaetocnema aridula*, Gyll., is usually more abundant than *C. hortensis*, Geoffr., of which the eggs in the soil are killed by hot dry weather. In 1936, the latter species appeared first and attacked the main stems of sprouting barley and summer wheat, whereas *C. aridula* was of no economic importance, as it infested plants at the period of tillering and damaged only the side shoots. In one locality it attacked *Phalaris* *canariensis*, which developed late, owing to late sowing and the prevailing drought, and produced a number of young shoots in July. From 20th July, the number of flea-beetles in the field decreased rapidly, and by the end of the month they had entered hibernation.

Popov (S. L.). **The Relation of Quick-grass to the Damage to Spring Crops by the Stem Flea Beetle** (pp. 62–64). Investigations in the Province of Saratov showed that stem flea-beetles [*Chaetocnema*], which appear in the fields soon after the melting of the snow and some time before the summer crops begin to sprout, concentrate in plots overgrown with *Agropyrum repens*. This grass is attractive to the females for oviposition and was found to be very heavily infested by the larvae. In the case of oats and summer wheat, the highest percentage of injured plants invariably occurred in fields that contained *A. repens* or were situated close to waste land overgrown with it.

Petrik (A. I.). **Observations on the Effect of Methods of Cultivation on** *Oria musculosa* (pp. 64–65). The stem Noctuid, *Oria musculosa*, Hb., causes considerable injury to cereals in the steppe zone of the Ukraine in years of outbreak [*cf.* **23** 566]. In investigations in 1934–36 in a district in the south-east on the relation of infestation to methods of cultivation, the maximum percentage of injured ear-bearing stems occurred in winter wheat in fields in which it had been grown for several years. Winter wheat sown in weedy fallow was less severely attacked, and wheat sown after deep tractor ploughing or in clean fallow was not infested. In stems injured in the early stages of development, the ears are killed while still in the sheath, whereas in later infestations, the stems throw out ears but are often cut in two by the larvae. When the winter wheat is reaching the milk stage, the larvae begin to enter the soil for pupation, which takes place at a depth of 2–4 ins. In 1936, mass pupation took place about 22nd June and adults were on the wing from 6th July, the flight lasting a month. Burning the stubble and deep autumn ploughing reduced infestation considerably.

Selivanova (S.). **Effect of meteorological Conditions on the Development of** *Laspeyresia nigricana* **Stph.** (pp. 65–67). *Cydia* (*Laspeyresia*) *nigricana*, Steph., which was previously erroneously recorded as *C.* (*L.*) *dorsana*, F. [**25** 143], is the only Tortricid that has been found on cultivated peas in the Province of Voronezh. Observations showed that the beginning of adult flight, which occurs in the second half of June, is dependent on temperature and not on atmospheric humidity. The temperature in the first half of July is decisive for the development of the eggs and larvae. As a rule, some of the latter have not left the pods at the time of the pea harvest, even when hot dry weather has favoured their development. As they cannot continue to feed on the peas once the pods are opened, it is important to thresh as soon as possible, irrespective of the weather.

Makeeva (E. A.). **Injury caused by Tortricidae to different Varieties of Peas** (pp. 67–68). Investigations in the Province of Voronezh of the pods of 50 varieties of peas, of which the maturation period varied from 63 to 83 days, showed that those with a short period of growth were much less infested by larvae of the pea moth [*Cydia nigricana*, Steph.] than late maturing varieties.

Stark (V. N.). **Division of the south-eastern Part of European U.S.S.R. into Regions based upon the Pests infesting Shelterbelts** (pp. 187–193). In view of the proposed afforestation of a number of districts in the south-east of European Russia, investigations were carried out in 1936 on the insect fauna of the already existing forests. From data obtained from the literature and observations in 42 localities, the territory is divided into five ecological zones, and the principal insect pests occurring in each are enumerated.

MEL'NICHENKO (A. N.). **Shelterbelts and the Multiplication of Field Crop Pests** (pp. 194–202). Investigations in 1936 in different localities in the steppe, forest-steppe and semi-desert zones in the south-east of European Russia on the effect of protective strips of trees on agricultural pests fully confirmed the chief conclusions obtained in 1935 [**25** 145]. It was also found that the number of insect species, whether adapted to mesophytic or xerophytic conditions, that concentrated on the borders of the strips progressively increased towards the south-east (in dry steppes and semi-desert), and that the belts of woodland acted as reservations for a variety of pests. On the other hand, they also harbour insectivorous birds and various insect parasites and predators, and the alteration in the microclimate of the fields cultivated between them increased the yield of the crops and more than compensated for the loss due to pests. The yield of wheat was greatest close to the strips, and there was a sharp drop in the yield in the distant plots owing to the severe drought.

VORONTZOV (A.). **Pests of Trees planted for ameliorative Purposes in Western Kazakhstan and the Volga German Republic** (pp. 202–205). Notes are given on the distribution, prevalence and economic importance of the chief insect pests of trees observed in natural and artificially planted forests and belts of woodland in the districts of Urda (western Kazakstan) and Stalingrad (Lower Volga Region) and in the Republic of the Volga Germans. The pests found in each area (23, 14 and 50 species, respectively) are enumerated. The most important were the Buprestids, *Poecilonota variolosa*, Payk., *Melanophila picta*, Pall., and *Dicerca aenea*, L., which caused severe damage to poplar and ash; the Cerambycids, *Chlorophorus herbsti*, Brahm, and *C. varius*, Müller, on white acacia [*Robinia*] and mulberry; the Chrysomelid, *Melasoma saliceti*, Weise, on ash, poplar and willow; *Lymantria* (*Porthetria*) *dispar*, L., on birch, pine and poplar; *Diprion sertifer*, Geoffr., on pine; *Saperda carcharias*, L., on ash and poplar; and *S. populnea*, L., on ash.

BEREZINA (V. M.). **Distribution of Soil Entomofauna in Sandy and Chestnut Soils of the Kamyshin Forest-ameliorative Base** (pp. 205–208). Examination of the soil in forests and belts of woodland in the district of Stalingrad showed that some insect pests preferred open spaces and strips with sparse trees, while others occurred only in soil that was shaded. The first group included *Maladera holosericea*, Scop., *Corymbites* (*Selatosomus*) *latus*, L., *Opatrum sabulosum*, L., *Anoxia pilosa*, F., *Polyphylla fullo*, L., and *Epicometis hirta*, Poda, and the second *Lacon murinus*, L., *Helops* (*Cylindronotus*) sp., and *Rhizotrogus aestivus*, Ol. Brief notes on the character of the soil in which the pests occurred are given. All species, with the exception of *M. holosericea*, were most numerous in strips of trees with very damp soil.

PRINTZ (Ya. I.). **The Effect of Soil Acidity on the Distribution of Larvae of** *Agriotes obscurus*, *Melolontha hippocastani*, *Amphimallus solstitialis*, *Polyphylla fullo*, *Anisoplia austriaca* (pp. 208–211). Larvae of various soil pests were placed in wooden boxes containing layers of soil of different hydrogen-ion concentrations. The number of the larvae in each layer varied from 5 to 15, and suitable food material was provided. Examination 5–15 days later showed that *Melolontha hippocastani*, F., and *Amphimallus solstitialis*, L., were concentrated in the layer of which the pH was 5–6, and *Agriotes obscurus*, L., at a pH of 5. *Polyphylla fullo*, L., and *Anisoplia austriaca*, Hbst., preferred soil with a pH of 7–8.

Kosmachevskiĭ (A. S.). **Seasonal Movements of** *Melolontha hippocastani* **Fabr.** (pp. 211–213). To determine the causes of the vertical migrations of larvae of *Melolontha hippocastani*, F., periodical examinations of the soil were carried out in a pine forest in the Province of Voronezh in 1935–36. It was found that the larvae hibernate at a depth of 16–56 ins. and begin to make their way upwards in the first half of May, when the mean day and night temperature reaches 8–9·2°C. [46·4–48·56°F.]. This migration begins sooner in well-lit than in the shaded localities. Its dependence on temperature was confirmed in laboratory experiments in which overwintered larvae in the second instar remained motionless when kept in soils of which the temperature ranged up to 8·4°C. [47·12°F.], but moved about at 9·2–9·8°C. [48·56–49·64°F.]. The larvae begin to descend into the deeper layers of the soil in the first ten days of October, when the temperature at a depth of 4 ins. drops to 7·6–9·2°C. [45·68–48·56°F.]. In the laboratory, second-instar larvae still moved at 7°C. [44·6°F.], which indicates that they are more resistant to cold in autumn than in spring. No relation was traced between the vertical migrations in summer and the temperature or humidity of the soil, but larvae nearer the surface weighed less than those in deeper layers. Having reached a certain weight (450–500 mg. for the second instar), the larvae descend to a deeper level, where their growth is retarded.

Kosmachevskiĭ (A. S.). **Development of the Larvae of** *Melolontha hippocastani* **Fabr. under natural Conditions** (pp. 213–214). Larvae of *Melolontha hippocastani*, F., that hatch at the end of June or beginning of July feed intensively and by the middle or end of August weigh 100–140 mg. They do not increase in weight during hibernation, but do so after feeding has been resumed in spring ; in July or mid-August they are in the second instar and weigh 500–600 mg. There is no further increase until the following year, when the larvae feed again and in the third instar weigh 1,600–1,800 mg. After this their development is retarded, apparently owing to some physiological process. In the laboratory, second-instar larvae did not moult, though the temperature sum was sufficient to complete the development of the instar, but entered the deeper and cooler layers of the soil and fed little. It was also found that larvae under certain temperature conditions develop uninterruptedly until they are full-fed ; before pupation, however, development is suspended for about three months. The larvae moult in the middle or the end of June, usually near the surface of the soil. Third-instar larvae that overwinter when their weight is 1,200–1,400 mg. pupate within the year.

Dubrovenskiĭ (V. F.). *Lytta vesicatoria* **L. under the Conditions of the Stony Steppe, Voronezh Region** (pp. 215–217). To determine the effect on ash of the damage caused by the adults of the Meloid, *Lytta vesicatoria*, L., in the Province of Voronezh, trees 7 years old were artificially infested with the beetles and covered with muslin cages on

14th June, so as to allow 25, 50, 75 and 100 per cent. of the foliage to be destroyed. Measurement of the trunks and shoots before the experiment and 2½ months later showed that the increase in growth of infested trees was reduced by about 22–46 per cent. as compared with the controls. In the case of naturally infested older trees, those of which only 5 and 75–95 per cent. of the foliage was destroyed lost 6 and 10 ins., respectively, in height, compared with controls. There was no loss in the diameter of the trunks 40 ins. from the root collar. Complete control of the beetles was obtained by dusting with sodium fluosilicate or calcium arsenite at the rate of 18 lb. per acre, or by spraying with 2 lb. Paris green, 4 lb. lime and 1 lb. soap in 90 gals. water.

Berezina (V. M.). *Rhizotrogus aestivus* **Ol.** (pp. 217–218). Larvae of the Melolonthid, *Rhizotrogus aestivus*, Ol., cause serious damage to forest trees, chiefly pine, in the south-east of European Russia, occurring in stands of 10 or more years of age, preferably those growing on sand. The life-cycle is apparently completed in two years. In the district of Stalingrad in 1936, the beetles concentrated on deciduous trees at the end of May, but did not feed much on the foliage. Eggs were laid in the soil in June, usually at a depth of 4 ins. Dead beetles occurred in the soil from the beginning of July. Pupation took place in July and August, usually at a depth of 8–12 ins., and the young adults remained in the soil for hibernation. The larvae occur in the soil down to a depth of 24 ins. but chiefly concentrate at 4–8 ins. Apparently they feed exclusively on the roots of trees, chiefly attacking those about 2 ins. in diameter. As a result of the infestation, the roots exude resin, which cements the particles of soil into gall-like formations, and shoots in the crowns turn yellow. Thinning overstocked stands favours the development of the trees and thus increases their resistance to infestation.

Nikol'skiĭ (V. L.). **Testing black Cyanide for disinfecting the Soil in Nurseries** (pp. 218–222). Experiments on soil fumigation with granulated calcium cyanide (20–22 per cent. HCN) were carried out in August 1936 in a nursery of oak seedlings in the Province of Voronezh at a mean temperature of 18·2°C. [64·76°F.], the temperature and moisture content of the soil (which was sandy-lime) being 20·1°C. [68·18°F.] and 5–8·3 per cent., respectively, at a depth of 6–8 ins. Of the insects found in the soil, larvae of *Polyphylla fullo*, L., and *Amphimallus solstitialis*, L., caused the most damage. They chiefly concentrated near the roots of the seedlings, unlike the other Lamellicorn larvae and wireworms, and most of them occurred within 8 ins. of the surface. The calcium cyanide, both alone and mixed with kerosene or sunflower seed oil at the rate of 1 pint to 9 lb., was applied in holes 8–10 ins. deep and at the rate of 2 oz. per sq. yard. Complete mortality of Lamellicorns or wireworms was not obtained after 8 days. Calcium cyanide with the vegetable oil gave the highest average mortality of Lamellicorns (76 and 73·6 per cent. when applied in holes 10 and 13 ins. apart, respectively). Mortality of wireworms was highest (83·3 and 68 per cent.) with calcium cyanide and kerosene. Oak seedlings with damaged roots were killed by the fumigation ; the foliage of healthy seedlings turned greyish-purple 2 days after the application, but recovered its normal colour in 3–4 days.

Shabanova (M. P.). **Black Cyanide as a Means of controlling Cockchafer Larvae** (pp. 222–224). In experiments carried out in

July–August in a pine forest in the Province of Voronezh, 96 per cent. mortality of second-instar larvae of *Melolontha hippocastani*, F., was obtained 10 days after fumigating the soil with granular calcium cyanide (22 per cent. HCN) applied at the rate of about 3 oz. per sq. yard, in holes 12 ins. apart at a depth of 4½ ins. When the holes were deeper, the intervals between them wider, or soil humidity high, the fumigant was less effective. Its radius of action was small; thus, all larvae within 4 ins. of the holes were dead, but only 52 per cent. at a distance of 6 ins. In a nursery of trees in which the soil was not covered by vegetation and the larvae chiefly concentrated near the roots, calcium cyanide introduced on parallel lines 4–4½ ins. from the trees in holes 4½ ins. deep and 13 ins. apart at the rate of about 0·4 oz. per hole, killed 69 per cent. of the larvae in one test and 28 per cent. in another. This dosage, when introduced at a distance of 2 ins., killed one-year old pines and oaks; it injured them at a distance of 4 ins., but did not affect them at 6 ins.

Parfent'ev (V. Ya.). **How Shelterbelts become infested with Forest Tree Pests** (pp. 224–227). In the Province of Saratov and the Republic of the Volga Germans, 68 species of insect pests have been found in protective strips of trees. Of these, 22 species, a list of which is given, are of special importance as they may easily be introduced into uninfested plantations. Defoliators such as *Lymantria* (*Porthetria*) *dispar*, L., and *Nygmia phaeorrhoea*, Don., and sucking insects such as Aphids are introduced with nursery stock, and pests of timber with cut wood, poles, etc. *Etiella zinckenella*, Treitschke, which is one of the chief pests of peas and lentils, and *Rhynchites auratus*, Scop., which attacks cherries and other stone fruits, are of particular importance, as they can pass from the shelter belts to these crops. Measures are indicated that would prevent breeding foci of insect pests in the protective strips.

Nikol'skiĭ (V. L.). **A Check of the Measures used by Forest Nurseries in the Voronezh Region** (pp. 227–233). Investigations in a tree nursery in the south-east of the Province of Voronezh showed that a system of rotation and thorough destruction of weeds proved effective in preventing infestation by *Amphimallus solstitialis*, L., and the Noctuids, *Euxoa segetum*, Schiff., and *Feltia exclamationis*, L. The Geotrupid, *Lethrus apterus*, Laxm., was successfully controlled by hand-collecting, and large numbers of larvae and adults of *Gryllotalpa gryllotalpa*, L., were caught in flower-pots let into the bottom of a ditch dug along a swamp that was the chief place in which it was breeding. Spraying the edge of a poplar plantation with 5 per cent. barium chloride gave up to 70 per cent. mortality of mature larvae of *Stilpnotia salicis*, L. Of the 5 Curculionids that attacked the seedlings, *Psalidium maxillosum*, F., and *Tanymecus palliatus*, F., were the most numerous and caused serious damage by feeding on the cotyledons and the first pair of young leaves. *Sitona crinita*, Hbst., attacked yellow and white acacia [*Caragana* and *Robinia*]. The Tenebrionid, *Opatrum sabulosum*, L., destroyed shoots close to the soil and the cotyledons of germinating seeds of various kinds of trees.

Gusev (V. I.). **Experiments on Pest Control in the Shelterbelts of the Stony-Steppe District of Voronezh Region** (pp. 233–238). The effective control measures adopted in a district in the Province of Voronezh against various pests of protective strips of woodland include felling and removing infested, weakened and diseased trees, and laying trap logs. Collecting fallen leaves of maple and lime considerably reduced the numbers of the Limacodid, *Heterogenea asella*, Schiff., the larvae of which hibernate in cocoons on the leaves. Dusting with sodium fluosilicate or calcium arsenite or spraying with a mixture of Paris green, lime and soap did not kill the young larvae of the Noctuid, *Moma* (*Diphtera*) *alpium*, Osbeck, on oak, as they congregate in groups on the lower surface of the leaves. Calcium arsenite applied from an aeroplane in the first half of August, however, killed the almost mature larvae, which are more accessible. In laboratory experiments in which dusted or sprayed oak twigs were artificially infested with the larvae in different instars, complete mortality was given in 36 hours by Paris green and calcium arsenite, and in 2 days by sodium fluosilicate. These insecticides also killed the adults of the Meloid, *Lytta vesicatoria*, L., in a few hours.

VESEY-FITZGERALD (D.). **Entomologist's Report.**—*Rep. Dep. Agric. Seychelles* ***1936*** pp. 17–18. Victoria, Seychelles, 1938.

Scale insect attack on coconuts still remains the major entomological problem in the Seychelles [*cf. R.A.E.*, A **21** 132] ; the chief species are *Ischnaspis longirostris*, Sign., *Eucalymnatus* (*Lecanium*) *tessellatus*, Sign., *Chrysomphalus ficus*, Ashm., and *Pinnaspis buxi*, Bch. Serious harm is caused to various fruit and other trees by *Icerya seychellarum*, Westw., and species of *Lecanium* [*sens. lat.*]. The Coccids in the Seychelles are very free from natural control other than by entomogenous fungi [**23** 241, etc.], though *Icerya* is checked by the Coccinellid, *Rodolia chermesina*, Muls., and by the Chrysopid, *Chrysopa flavostigma*, Esben-Petersen. Natural enemies introduced from East Africa during 1936 comprised the Aphelinid, *Aphytis chrysomphali*, Merc., parasitic on *Ischnaspis*, and the predacious Coccinellids, *Chilocorus distigma*, Klug, *C. wahlbergi*, Muls., *Exochomus ventralis*, Gerst., and *Hyperaspis usambarica*, Weise, and all except *Aphytis* and *Hyperaspis* became established.

Coconut palms are still severely attacked by the Lymexylonid beetle, *Melittomma insulare*, Fairm., the larvae of which feed in the tissue at the base of the boles [**15** 568]. Palms may be killed either by the cumulative effect of constant feeding or rapidly by a severe attack, which causes the leaves to wither and fall and the trunks to die standing. Dead palms, including their bases, should be burnt, but less seriously infested palms may be protected by earthing up the bases to prevent oviposition, and cutting out the affected parts and tarring cavities or filling them with cement.

Minor pests not recorded in previous reports included the weevil, *Cratopus aurostriatus*, Fairm., defoliating takamaka (*Calophyllum inophyllum*) ; *Pyrausta phoenicealis*, Hb., and *Dichomeris ianthes*, Meyr., of which the larvae feed on the leaves of the essential oil plant, *Ocimum sanctum*, and *Indigofera endecaphylla*, respectively ; the Pentatomid, *Acrosternum spicatum*, Dist., puncturing the pods of the cover crop, *Crotolaria anagyroides* ; *Megachile seychellensis*, Cam., at times almost completely defoliating *Derris* and roses ; and the Coccids, *Eucalymnatus* (*Lecanium*) *perforatus*, Newst., *Chrysomphalus ficus*, *C. dictyospermi*, Morg., and *Coccus mangiferae*, Green, all attacking cinnamon. *Polistes macaensis*, F., and *Odynerus seychellensis*, D. T., were predacious on *P. phoenicealis* and *D. ianthes*.

Johnpulle (A. L.). **Temperatures lethal to the Green Muscardine Fungus,** *Metarrhizium anisopliae* **(Metch.) Sorok.**—*Trop. Agriculturist* **90** no. 2 pp. 80–83, 1 graph, 4 refs. Peradeniya, February 1938.

The results are given of laboratory investigations to determine the temperatures at which *Metarrhizium anisopliae* can be propagated in compost pits for the control of the larvae of *Oryctes rhinoceros*, L., on coconut plantations in Ceylon [*cf. R.A.E.*, A **25** 299]. Exposure to temperatures of 50°C. [122°F.] and above for 5 minutes inhibited germination of the spores in every case. The spores had a low thermal death point, but 42°C. [107·6°F.] was definitely not lethal to them, and some germinated after an hour's exposure to 48°C. [118·4°F.]. The temperature changes in a pit of the type usually laid down in coconut land is shown in a graph. A temperature of about 70°C. [158°F.] is soon reached and is maintained for nearly 2 weeks. A gradual decline follows, but the temperature does not fall well below 48°C. until the pits are nearly 6 weeks old. Inoculation of the pits may then be undertaken, and this gives the fungus at least 12 weeks in which to destroy the larvae and pupae [*cf.* **25** 300]. As it kills the larvae in the laboratory in a much shorter time, successful control in compost pits appears possible.

C[orbett] (G. H.). *Oryctes rhinoceros* **L. and Oil-palms. A Warning.**—*Malay. agric. J.* **26** no. 3 p. 113. Kuala Lumpur, March 1938.

Oryctes rhinoceros, L., although more prevalent on coconut palm, is becoming increasingly evident on oil palm [*Elaeis guineënsis*] in Malaya, two sources of infestation recently discovered being decaying stumps and logs of the rubber tree [*cf. R.A.E.*, A **24** 104] and compost heaps. With the disappearance of rubber from the oil-palm plantations, this Dynastid should not cause further anxiety ; but if the making of compost heaps becomes a regular estate practice, it may develop into a more important pest of oil palm. The constituents of the heaps in their relation to the oviposition of the Dynastid are discussed. It is not known how long it takes for rotting pericarp and fruit bunches to attract the adults ; the period probably varies from 3 to 6 months. In any case, however, cattle manure (one of the constituents) attracts the beetle for oviposition, and during the preparation of the heaps or stacks all larvae and adults should be collected and destroyed. Compost about 1 in. in thickness at the rate of 6–7 tons per acre is generally placed between the rows of palms in trenches about 5 ft. wide and 3–6 ins. deep and covered with soil. If it is so applied or spread on the soil surface at the same rate, any larvae in it would be unlikely to reach maturity in a mineral soil, but might do so in a soil of an organic or peaty character. The adult would not be attracted to the compost for egg-laying whether the soil is of a mineral, peaty or loamy consistency.

de Fluiter (H. J.). *Orphinus* **spec., een Dermestide, schadelijk voor tabakszaad (aanvulling).** [*Orphinus* sp., a Dermestid injuring Tobacco Seed (addendum).]—*Meded. Besoekisch. Proefst.* no. 59 p. 23. Surabaya, 1938.

The Dermestid of which larvae, pupae and adults were found in a sample of tobacco seed in Java [*R.A.E.*, A **25** 532] has been identified as *Orphinus aethiops*, Arrow.

MURRAY (G. H.). **Outbreak** *Promecotheca antiqua*—**Lindenhafen Estate.**—*New Guinea agric. Gaz.* **3** no. 2 pp. 1–2. Rabaul, December 1937. [Recd. April 1938.]

An account is given of an outbreak of *Promecotheca papuana*, Csiki (*antiqua*, Weise) on a coconut plantation, stated to be the worst on record in the Territory of New Guinea. In January 1937, there was much immature nutfall, many palms had died and all were so weakened by the infestation that no crop could be expected for two years. The bionomics of this Hispid are briefly described [*cf. R.A.E.*, A **24** 466]. It is believed to have spread from neighbouring sago palms (*Metroxylon sagu*), and leaves of these found infested should in future be cut off and burnt as a preventive measure. A method of control that has sometimes been employed is to place nests of the predacious ant, *Oecophylla smaragdina*, F., in the crowns of some of the coconut palms, and join them to others with ropes or string to enable it to spread. The author has himself observed the ants destroying adults of *Promecotheca*.

FROGGATT (J. L.). *Promecotheca antiqua* **Wse. Leaf Pest of Coconuts.**—*New Guinea agric. Gaz.* **3** no. 2 pp. 21–22, 1 ref. Rabaul, December 1937. [Recd. April 1938.]

An unidentified Hymenopterous parasite of the larvae of *Promecotheca papuana*, Csiki (*antiqua*, Weise), which appeared to be fairly numerous, was found on Manus Island in March 1937. In the initial stages of an infestation by this Hispid, collecting the adults, rubbing off the egg masses and crushing the young larvae in infested leaflets are recommended for young coconut palms, and the destruction of infested fronds for older ones. The possibility of control by power dusting is to be tested. The desirability of encouraging *Oecophylla smaragdina*, F. [*cf.* preceding abstract] is questionable, as it fosters Coccids and may adversely affect pollination.

FROGGATT (J. L.). *Ephestia cautella* **Wlk. Moth Pest of Stored Cocoa Beans and Copra.**—*New Guinea agric. Gaz.* **3** no. 2 p. 23. Rabaul, December 1937. [Recd. April 1938.]

Larvae of *Ephestia cautella*, Wlk., have been found infesting consignments of cacao beans exported to Australia from the Territory of New Guinea. This moth has been found to breed commonly in copra, and all available evidence indicates that the dried cacao beans became infested from copra stored nearby.

FROGGATT (J. L.). **Egg Parasites of** *Sexava* **spp. in the Territory of New Guinea.**—*New Guinea agric. Gaz.* **3** no. 2 pp. 24–25. Rabaul, December 1937. [Recd. April 1938.]

Notes are given on a number of egg parasites of the species of *Sexava* attacking coconut, found during a search in several islands in the territory of New Guinea [*cf. R.A.E.*, A **25** 741, etc.]. Three found in New Hanover alone appeared of economic importance, namely *Doirania leefmansi*, Wtstn., and *Leefmansia bicolor*, Wtstn., which were about equally numerous, and an unidentified Mymarid, which was almost as common. As in the laboratory only *L. bicolor* bred freely, and the Mymarid failed to complete a single life-cycle, it is suggested that the introduction of the parasites from New Hanover to other islands should be effected by collecting and transporting infested *Sexava* eggs.

MURAYAMA (J.). **Studies on Lamellicorns in Korea.** [*In Japanese.*]—*Rep. Jap. Ass. Adv. Sci.* **13** no. 2 pp. 259–264. Tokyo, April 1938.

The Lamellicorns occurring in Korea comprise 123 species. Of about 20,000 adults collected during a period of 5 years, 32 per cent. were *Lachnosterna* (*Holotrichia*) *diomphalia*, Bates, 14 per cent. *L.* (*H.*) *titanis*, Reitt., 9·7 per cent. *Miridiba koreana*, Niij. & Kino., and 0·11 per cent. *Anomala* (*Phyllopertha*) *pallidipennis*, Reitt., while of about 10,000 larvae collected in nurseries during 6 years, 53 per cent. were *A. pallidipennis* and 15 per cent. *L. diomphalia* [*cf. R.A.E.*, A **23** 370]. A table is given showing the emergence periods of adults of 14 common species. *A. pallidipennis*, *Aserica* (*Serica*) *orientalis*, Motsch., and *Mimela* (*Anomala*) *testaceipes*, Motsch., complete a life-cycle in a year, and *L. diomphalia* completes it in 2 years. In Korea, the ground freezes in winter to a depth of 20–28 ins.; larvae of *A. pallidipennis* and adults of *L. diomphalia* were found hibernating in the frozen soil, while the larvae of *L. diomphalia* and *M. testaceipes* were found in deeper unfrozen soil. The third-instar larvae of *L. diomphalia* survive submersion in water for 2 days, but the larvae of *L. titanis* are killed when submerged for 1 day. The prepupal stage is the critical period in the life-cycle of these insects, and is easiest to control with soil fumigants (carbon bisulphide or an emulsion of it, or paradichlorobenzene) or by mechanical methods. Collecting the larvae in the autumn before they enter the deeper soil is also recommended.

SUGIMOTO (M.). **Tyroglyphid Mites and their Injuries.** [*In Japanese.*]—*J. Taihoku Soc. Agric. For.* **2** no. 3 pp. 282–290, 1 fig. Taihoku, November 1937. [Recd. April 1938.]

A description is given of *Carpoglyphus taiwanensis*, sp. n., taken in sugar at Taihoku, Formosa, together with general notes on the morphology of Tyroglyphid mites and the injury they cause.

UCHIDA (H.). **Relation of the Development of the Egg, Larva and Pupa of *Chaetodacus cucurbitae* Coq., to the fatal Effect of Fumigation with Carbon Bisulphide. (Preliminary Report.)** [*In Japanese.*]—*Shokubutsu-kensa Shiryo* **7** no. 3 pp. 24–25. Taihoku, April 1938.

Further investigations on the effect of fumigation with carbon bisulphide on *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., at Taihoku [*cf.*

R.A.E., A **24** 699] showed that the effectiveness of the fumigant against the eggs increases with their stage of development. The larvae were least resistant in the first instar and most resistant in the middle of the third. Resistance was greater at the end of the third instar than at the beginning. In the pupal stage, which lasts 10 days at 24°C. [75·40°F.], it was greater in the middle than at the beginning. The degree of susceptibility seems to be correlated with the amount of respiration.

MAKI (T.). **Studies on** *Ischnodemus saccharivorus* **Okajima.** [*In Japanese.*]—*Kagoshima agric. Exp. Sta., Oshima Br. Extra Rep.* no. 2, 104 pp., 6 pls. Naze, Amami-oshima, Japan, 1937. [Recd. April 1938.]

On the island of Amami-oshima (Loochoo Islands), sugar-cane is attacked by a number of serious pests, most of which seem to have been introduced in recent years. They comprise the Aphid, *Oregma* (*Ceratovacuna*) *lanigera*, Zehnt., the Elaterid, *Melanotus tamsuyensis*, Bates, the moth borers, *Eucosma schistaceana*, Sn., *Scirpophaga nivella*, F., and *Sesamia inferens*, Wlk., and the Lygaeid, *Ischnodemus saccharivorus*, Okaj. *I. saccharivorus*, all stages of which are described, probably originated in Formosa; it appeared in Amami-oshima in 1916 and caused very serious damage in 1922. It also attacks maize and various grasses, being especially injurious to sugar-cane in summer.

Observations on its bionomics [*cf. R.A.E.*, A **24** 629, etc.] showed that there are 3 generations a year; the adults appear in June, from August to September and from late October to early November. The winter is passed in the egg and adult stages. Both macropterous and brachypterous forms occurred, and the males slightly outnumbered the females. The overwintered females began to deposit masses of 8–12 eggs between the leaf sheaths from February, about 8 days after emergence from hibernation. A female produces a maximum of 277 eggs at the average rate of 28 per day. The egg stage lasted 14–19 days in summer, 74–84 in spring and 106–173 in winter. The nymphs were found congregated under the leaf sheaths or in other sheltered places on the food-plants; they could survive 12 days without food in conditions of moisture. The eggs were parasitised by a Scelionid of the genus *Telenomus* (*Phanurus*), the adult of which is described. It has 7 or 8 generations a year, its life-cycle lasting 28–30 days in spring and 19 days in summer.

In tests of insecticides for control, the eggs proved more resistant than the nymphs. Nicotine sulphate was found to be most effective against the latter [*cf.* **24** 697]. It should be applied once in late April or early May and again 2 weeks later. The fields should be cleared after the harvest. Fumigating canes with carbon bisulphide (8 oz. per 100 cu. ft. for 24 hours) injured the buds, but submerging them in water at 40, 50 and 80°C. [104, 122 and 176°F.] for 90, 60 and 5 seconds, respectively, killed all stages of the insect and did not injure the buds.

INOUYE (M.). **Contribution to the Biology and Control Methods of** *Chermes*. [*In Japanese.*]—*J. For. Soc. Japan* **19** no. 12 pp. 702–719. Tokyo, December 1937. [Recd. April 1938.]

The two species of *Chermes* dealt with in this paper attack spruces (*Picea* spp.) and migrate from one to another but not to trees of other genera. *C. japonicus*, Monzen [*cf. R.A.E.*, A **17** 707] is found in Honshu and Hokkaido, where it seriously damages trees 10–30 years old. It causes galls, retards growth and sometimes kills the trees. Eggs laid by winged females when they migrated to *Picea sitchensis* in the first half of September began to hatch on the last day of that month. The young nymphs hibernated on the winter buds and became apterous females in late April, each laying about 33 eggs in May. The resulting nymphs hatched from mid-May to June and formed galls, the winged forms from which migrated in September, laying an average of 68 eggs about 3 days after emergence. The larger galls contained more nymphs than the smaller ones, and those on *P. sitchensis* contained more than those on *P. jezoensis*. The nymphs, after emerging from the galls, moulted to the adult stage in 2 days at 16°C. [60·8°F.].

C. ishiharai, Inouye, attacks *Picea canadensis* and *P. glehni* in Hokkaido [*cf.* **25** 478]. Nymphs that overwintered on the buds of *P. canadensis* became apterous females and oviposited in early May, depositing about 420 eggs. The resulting nymphs hatched later in May and formed galls, from which winged adults emerged about the end of June and migrated to other spruces. They oviposited in 1 or 2 days, laying about 25 eggs, and the nymphs hatched in early July and hibernated.

Collecting the galls is not practicable for control, since it would have to be carried out over large areas, but spraying against the hibernating nymphs in late April and measures to improve the strength of the trees are recommended.

MOTOOKA (K.). **On Insect Pests of** *Camellia*, **2.** [*In Japanese.*]—*J. Plant Prot.* **25** no. 4 pp. 261–266. Tokyo, April 1938.

Further pests of *Camellia* in Japan [*cf. R.A.E.*, A **26** 311] include *Curculio* (*Balaninus*) *camelliae*, Roel., which has one generation a year, the adults emerging from late June to early July. The eggs are laid in the fruits, and the larvae feed on the seeds. *Camellia* is also attacked by a mite of the genus *Tetranychus*, the Jassid, *Ledra auditura*, Wlk., and a number of other minor pests, brief notes on which are given.

OKADA (I.). **On** *Scatopse fuscipes* **Meigen injuring the edible Fungus,** *Armillaria matsutake* **Ito et Imai.** [*In Japanese.*]—*Mushi* **11** no. 1 pp. 16–18, 1 fig. Fukuoka, April 1938.

A description is given of *Scatopse fuscipes*, Mg., which infests *Armillaria matsutake* in Japan and Korea.

OOZI (Y.). **On** *Phyllocnistis citrella* **Stainton.** [*In Japanese.*]—*Ent. World* **6** no. 49 pp. 223–228, 1 pl. Tokyo, April 1938.

Phyllocnistis citrella, Stn., all stages of which are described, occurs in south-western Japan, the Loochoo Islands and Formosa, and attacks various species of *Citrus* [*cf. R.A.E.*, A **24** 631]. It is most injurious in mid-summer and autumn, damaging the young leaves, especially of young trees. In Kyushu, the adults are present from mid-May to early November, and there seem to be at least 6 generations a year. In May, the larval and pupal stages last 9 and 10 days, respectively, the life-cycle being completed in about 25 days.

ESAKI (T.) & SAMESHIMA (T.). **Report on the Leaf-hoppers injurious to the Rice Plant and their natural Enemies, no. 9 (for the Year 1937).** [*In Japanese.*]—36 pp., 1 fig., 1 pl. Fukuoka, Dep. Agric., Kyushu Imp. Univ., April 1938.

Jassids and Delphacids were very scarce on rice near Fukuoka in 1937 and injury by them was scarcely noticeable [*cf. R.A.E.*, A **25** 380]. The numbers taken in a light trap at Oita are shown in tables and graphs. *Nephotettix bipunctatus cincticeps*, Uhler, was abundant in mid-June, early August and especially early September, while *Deltocephalus dorsalis*, Motsch., was scarce in June and July, but greatly increased in early September. The numbers of individuals of *Nephotettix* with coloration of the other sex are given in a table. Of the examples of this Jassid collected in the Oita Prefecture, 36·6 per cent. were parasitised by the Stylopid, *Tettigoxenos orientalis*, Esaki & Hshm. The hosts, which are sterilised by the parasites, appear to survive about 2 weeks after the latter leave them. Of the males having female coloration, 49 per cent. were found to be parasitised by a species of *Pipunculus*. In further experiments on the transmission of dwarf disease of rice by *Nephotettix*, plants fed on by the infected insects showed the symptoms first on the leaves and stalks that were directly inoculated, and then on other leaves and stalks. When the branch shoots were inoculated, the main stalks showed no symptoms or only a very slight infection. The younger leaves and stalks were generally more easily infected than the older ones.

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